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The Province of Alberta

PETROLEUM AND NATURAL GAS CONSERVATION BOARD

IN THE MATTER OF THE GAS RESOURCES PRESERVATION ACT

AND IN THE MATTER of a Joint Hearing to determine various questions
relating to the proposed Export of Natural Gas from the Province of Alberta.

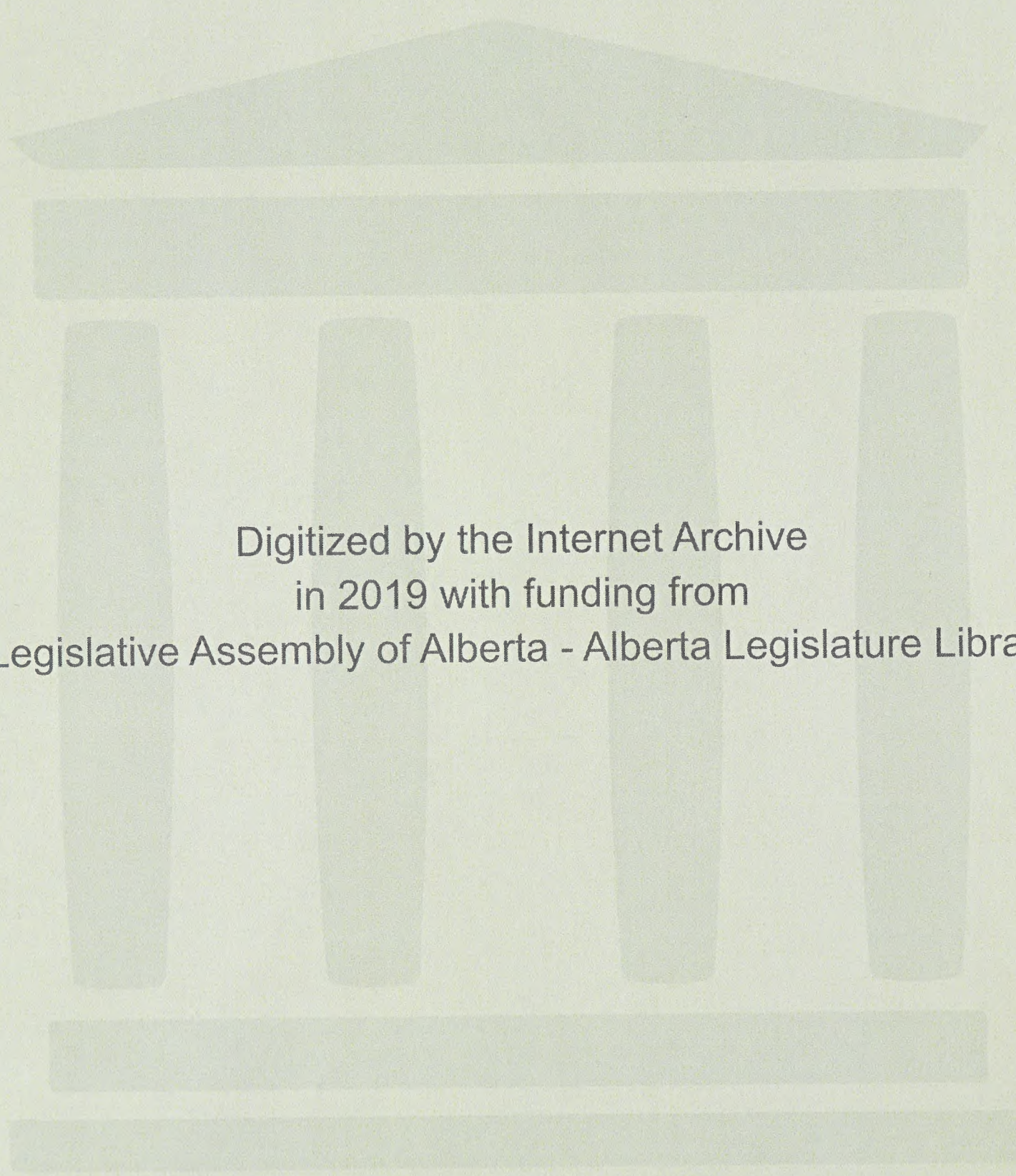
I. N. McKinnon Esq., Chairman

D. P. Goodall Esq.

Dr. G. W. Govier

Session: November 10, 1950.

Volume 10.



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I N D E X

VOLUME 10.

November 10th, 1950.

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G. E. G. LIESEMER (recalled):

MR. McDONALD:

I have no further questions

at this time, sir.

MR. MARTLAND:

Any questions I have, sir,

have already been covered so I have no questions to ask.

MR. C.E. SMITH:

I wonder might I ask about

two questions, sir, before the Board wants to examine the witness. Mr. Liesemer, since yesterday afternoon and having been examined to some extent, I think by Mr. McDonald, maybe there is with respect to areas that you had not dealt with in detail, -I think as a matter of fact you examined the yellow bible called the Hume Report?

A Yes, sir.

Q And you have prepared estimates in place for Athabasca, and Bon Accord?

A No, I did not have time to prepare those estimates.

Q You took them from Hume?

A Yes.

Q And you have available now his estimates in place?

A Yes.

Q And you have totalled those, and you also show on this document that I have in my hand Hume's in place and Liesemer's in place, and you show that you come out about on a 7.8% difference?

A That is correct.

Q With your permission, sir, I think it might be of assistance to some of the gentlemen present if they could see

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probably what is in this.

THE CHAIRMAN:

That will be Exhibit J-45.

CHARTS SHOWING ESTIMATES
IN PLACE PUT IN AND MARKED
EXHIBIT J-45.

Q MR. SMITH:

And I think also, Mr.

Liesemer, probably because of Mr. McDonald's examination with respect to Pouce Coupe you also located Hume's reserves in place and you found it to be 48 billion?

A Yes.

Q 48.3, I think?

A Yes.

Q And your own, as a matter of fact, is 60?

A That is correct.

Q I think that is all, sir.

EXAMINATION BY DR. GOVIER:

Q Mr. Liesemer, I am rather anxious to establish just exactly the basis on which your report was prepared. I would like to ask you about your reference on paragraph 1, page 1, where you refer to the American Gas Association Committee on reserves. You state, Mr. Liesemer, the definitions of this Committee have been followed as far as consistent with local experience and conditions. Just what are you referring to in that connection?

A Principally I had in mind paragraph 5,

"In general, 80% of the 'in place' estimate is considered approximate recovery for water drive fields and down to 100 pounds or lower bottom hole pressure in gas drive fields."

Mr. [Name] [Address]
[City, State, Zip]
[Phone Number]

Dear Mr. [Name]:
[First paragraph of letter]

[Second paragraph of letter]

[Third paragraph of letter]

[Fourth paragraph of letter]

[Fifth paragraph of letter]

Sincerely,
[Signature]

[Back of letter with faint text and lines]

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Local experience in such places as Bow Island and Barnwell which had been produced to exhaustion indicates 200 pounds closed in at the surface as a more practical abandonment point.

Q So you would differ with the Committee with respect to abandonment pressure?

A In the shallow fields, yes.

Q Would you not agree, Mr. Liesemer, that the abandonment pressure itself is really infinitely tied in with the deliverability schedule of the well and that to some extent it may be more realistic to consider gas in place and a deliverability schedule and assume that the reserve would have to be abandoned when the deliverability falls to an uneconomic point?

A That is correct.

Q But since you do not make a deliverability schedule you have assumed abandonment pressure as a close approximation?

A Close approximation. As a matter of fact, that is actually the way it works, these wells cease to be commercial producers in that vicinity.

Q Have you checked to see how closely that compares to what Mr. Davis gave us on a number of fields in the United States which had been produced to abandonment? I believe that that evidence indicated that some 65 to 70 - - I have just forgotten the figure, as a matter of fact - but Mr. Davis's evidence indicated that a certain percentage of the gas in place was ordinarily recoverable over 20 years or so?

A In the Viking sand in the Bow Island it looks like about

Ex-101-1000
Ex-101-1000

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... it is not clear from the evidence whether or not the defendant was aware of the fact that the defendant was in possession of the same.

... the defendant was in possession of the same at the time the same was seized.

... the defendant was in possession of the same at the time the same was seized.

A: ...

Q: ...

... the defendant was in possession of the same at the time the same was seized.

A: ...

Q: ...

... the defendant was in possession of the same at the time the same was seized.

A: ...

Q: ...

A: ...

Q: ...

... the defendant was in possession of the same at the time the same was seized.

A: ...

Q: ...

... the defendant was in possession of the same at the time the same was seized.

A: ...

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70%, 75% at first look.

Q That is to the abandonment pressure you have used?

A That is right.

Q So that in that case it would be consistent with Mr. Davis's view?

A Yes.

Q That means that you agree with the A.G.A. Committee on Reserves with the exception of what you have told us about paragraph 5. Are there any other places in which you differ?

A I never attempted to make the break-down on the basis of non-associated or associated.

Q And your pressure base on paragraph 4?

A Yes, that is correct, 14.4 and 60°. The other things I mention of reserve estimates should be on the basis of paragraph 14 of proved reserves.

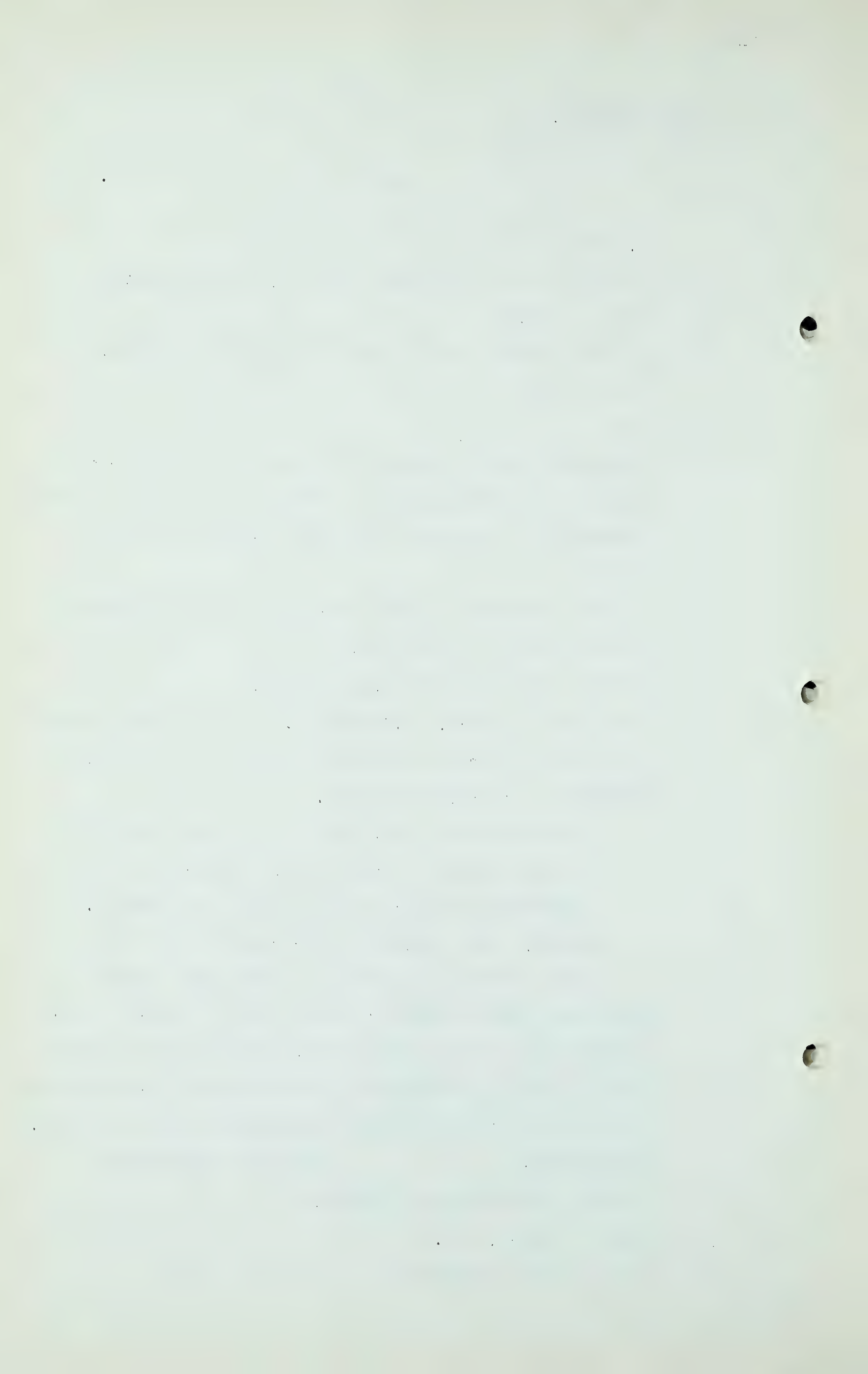
"A discovery well may prove a few acres around the well or several thousand acres, depending on the information available and the type of structure. However, care should be exercised to limit the area to that proved beyond a reasonable doubt."

Now, there were a number of areas which in strict justice probably should have been included but in this we were dealing with the problem of how much could be economically gathered and I limited myself to anything over 20 billion.

Q THE CHAIRMAN: Were you not asked to prepare a statement of reserves?

A That is correct, yes.

Q You said you limited it?



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A On the directive I received from the Board. That was strictly my own opinion, Mr. McKinnon.

Q Is not the Board by nature of the Act required to take into consideration all the Provincial requirements, which would not be merely the two main gas companies supplying local communities?

A That could be so. I could not see where anything like Lloydminster or Vermilion-Battleview would add anything on the overall problem. Those are small local reserves.

Q Wouldn't it be the problem of making up any deficiencies for those communities and to do so we should know what was available to them?

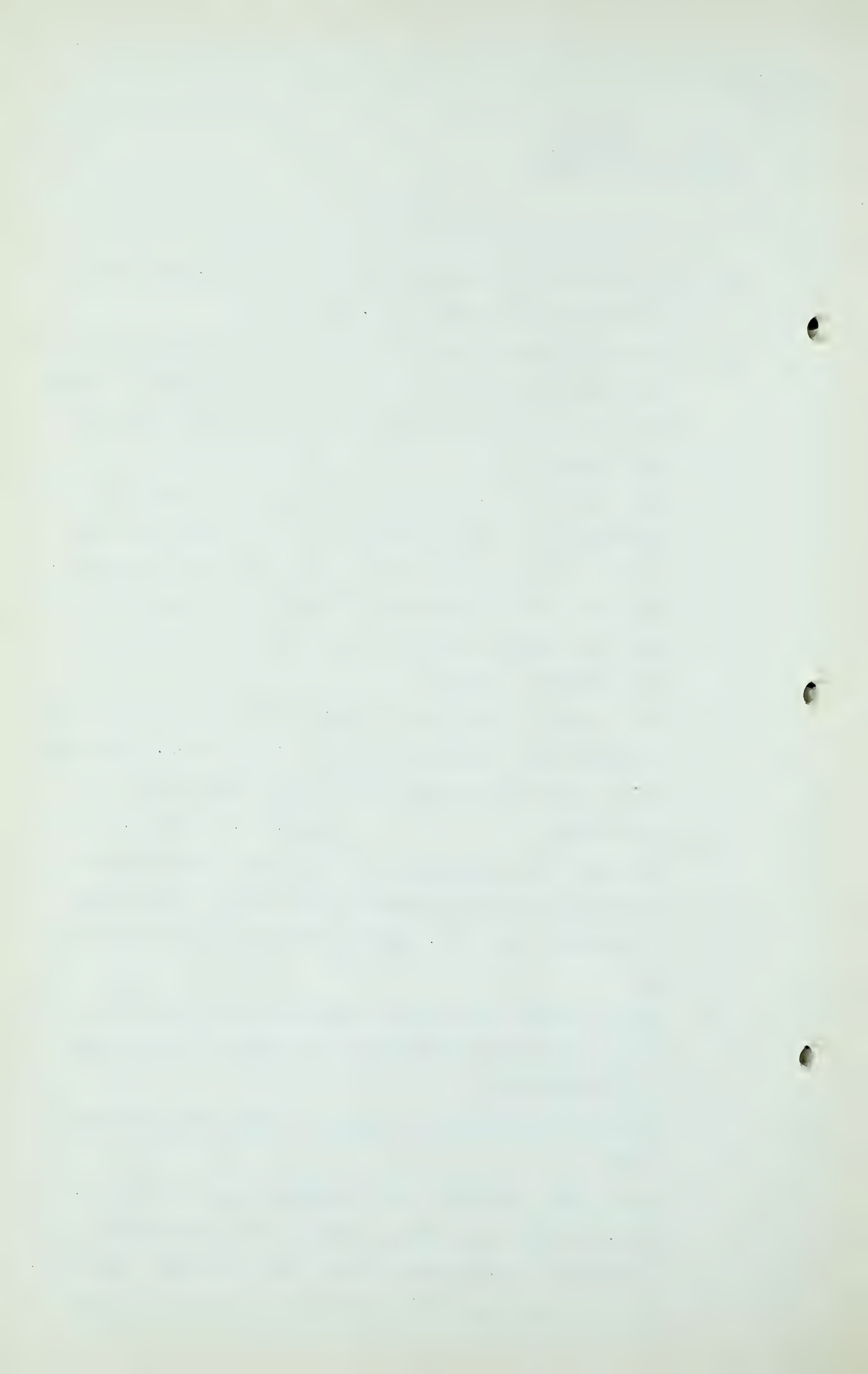
A The only two I think are in danger I think I included in my report, but I did not include in the total. I mentioned the condition at Vermilion and at Lloydminster.

Q DR. GOVIER: Then, Mr. Liesemer, do you agree with paragraph 1 of this A.G.A. Committee on Reserves statement that every cubic foot of gas should be included, that is, subject to what you have just told us?

A Again I thought that local conditions and the purpose of this particular Hearing that I would not bother with every cubic foot.

Q So that is another way in which you have deviated from this?

A As you will see from J-45, the amount that I omitted, 365.7 billions, according to Hume, would only make a difference of possibly a little better than 5%. However, if you include Morinville and Princess Basal Colorado,



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possibly 10% or 11%.

Q Paragraph 10 of the A.G.A. Committee on Reserves statement also makes reference to the fact that all proved reserves of natural gas, whether presently being produced or not, should be included. Have you done that with the exception of these small ones you have already told us about?

A Yes, I think I have taken everything into consideration within the limits of time. I think there will be a small reserve at Joseph Lake, but that is in the course of being developed and I hated to put a number on it.

Q But you have included fields which are not now being produced?

A Yes. Provost, for instance, and the Upper Porous in the Devonian at Princess.

Q Then paragraph 14 is the paragraph you quoted yourself a moment ago?

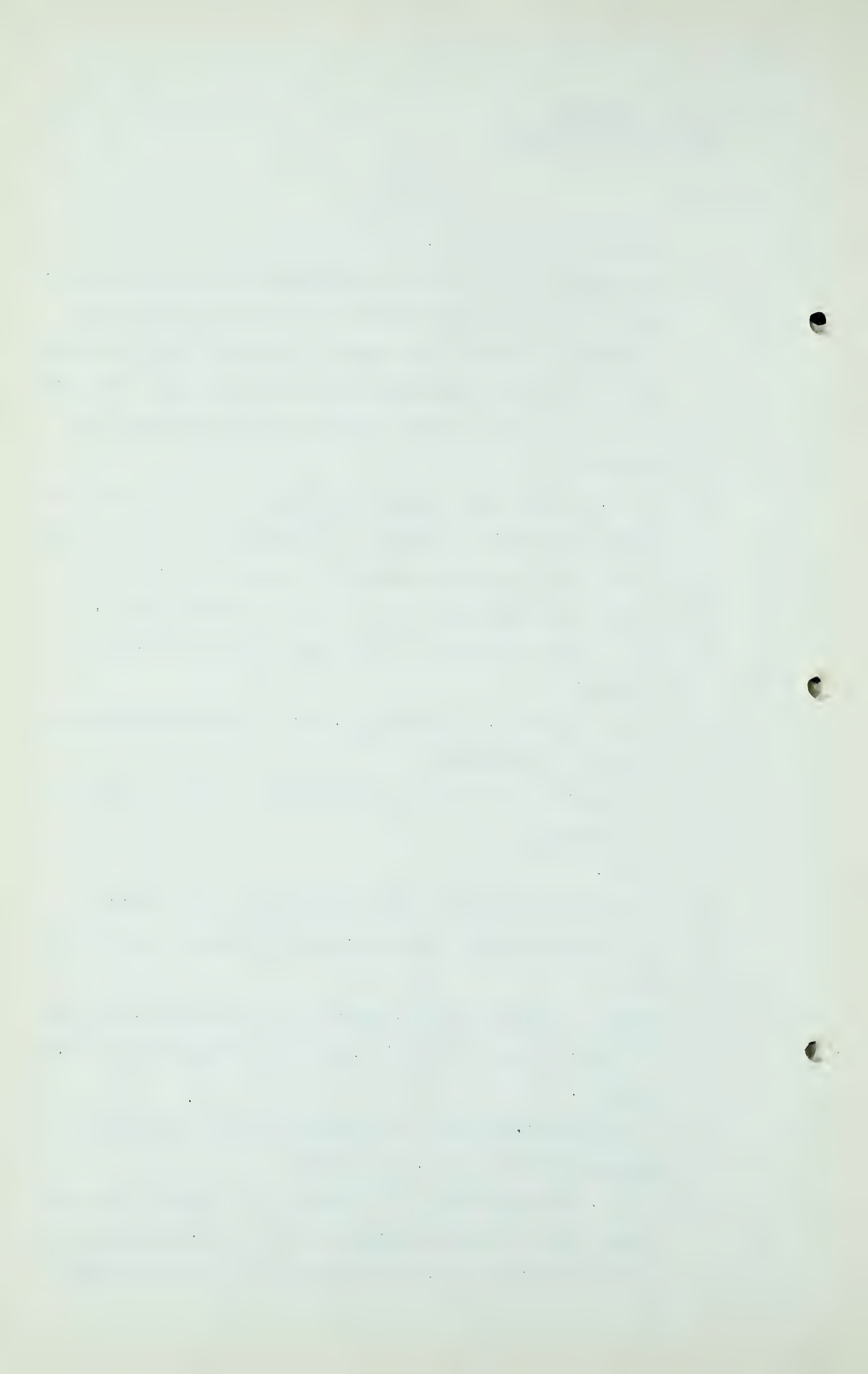
A Yes.

Q Have you adopted any rule-of-thumb as to the acreage you would consider proven around an isolated discovery well?

A That is a most difficult problem. I think Dr. Hume used a circle a mile in radius, which would approximate 2,000 acres.

Q I think Mr. Mackenzie of Imperial Oil was in general agreement with that, was he not?

A Yes. They say here it is a matter of judgment. In the case along the Lower Cretaceous with the exception of the Sunburst field, for instance, I do not know of any



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one continuous sand in the Lower Cretaceous that we have ever proved in extent to 2,000 acres. For that reason I was very much prone to stay under that figure for the Lower Cretaceous.

Q You are accepting the Sunburst sand under Princess?

A Yes. Mr. Crockford, my colleague, made a very exhaustive study of that.

Q Isn't that equivalent to accepting the only Lower Cretaceous field that you list?

A No, I listed the Lower Cretaceous at Leduc too, I believe.

Q Oh yes, I am sorry. At Leduc-Woodbend you have 32?

A There were above five different areas there.

Q And this is the total?

A This is the total. Five or six, I am not sure which.

Q In other words, your experience in the Lower Cretaceous, except at the Princess Sunburst sand, would indicate to you that 2,000 acres was too much to assign to a Lower Cretaceous well?

A That was my opinion.

Q What acreage would you believe to be a more reasonable figure, Mr. Liesemer?

A It would depend upon what particular portion of the Lower Cretaceous you had in mind. The Colony sand, and this is not in Alberta, this is Saskatchewan, it might be safe to assume 640 acres, possibly a thousand acres for a Colony sand for a few wells in the Sparky zone in Lloydminster it looks like 160 acres might be the maximum. From the experience they have had drilling at the Campbell pool I would hate to go beyond 160 acres for

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what we have seen actually drilled out of the Basal Quartz.

Q Is that the Morinville? Would that be applicable to the Morinville area?

A Well, it is 9 miles away. There might be some profound change in the bedding, I do not know. We have been hoping for years to find a good Lower Cretaceous field. That may be one, I do not know.

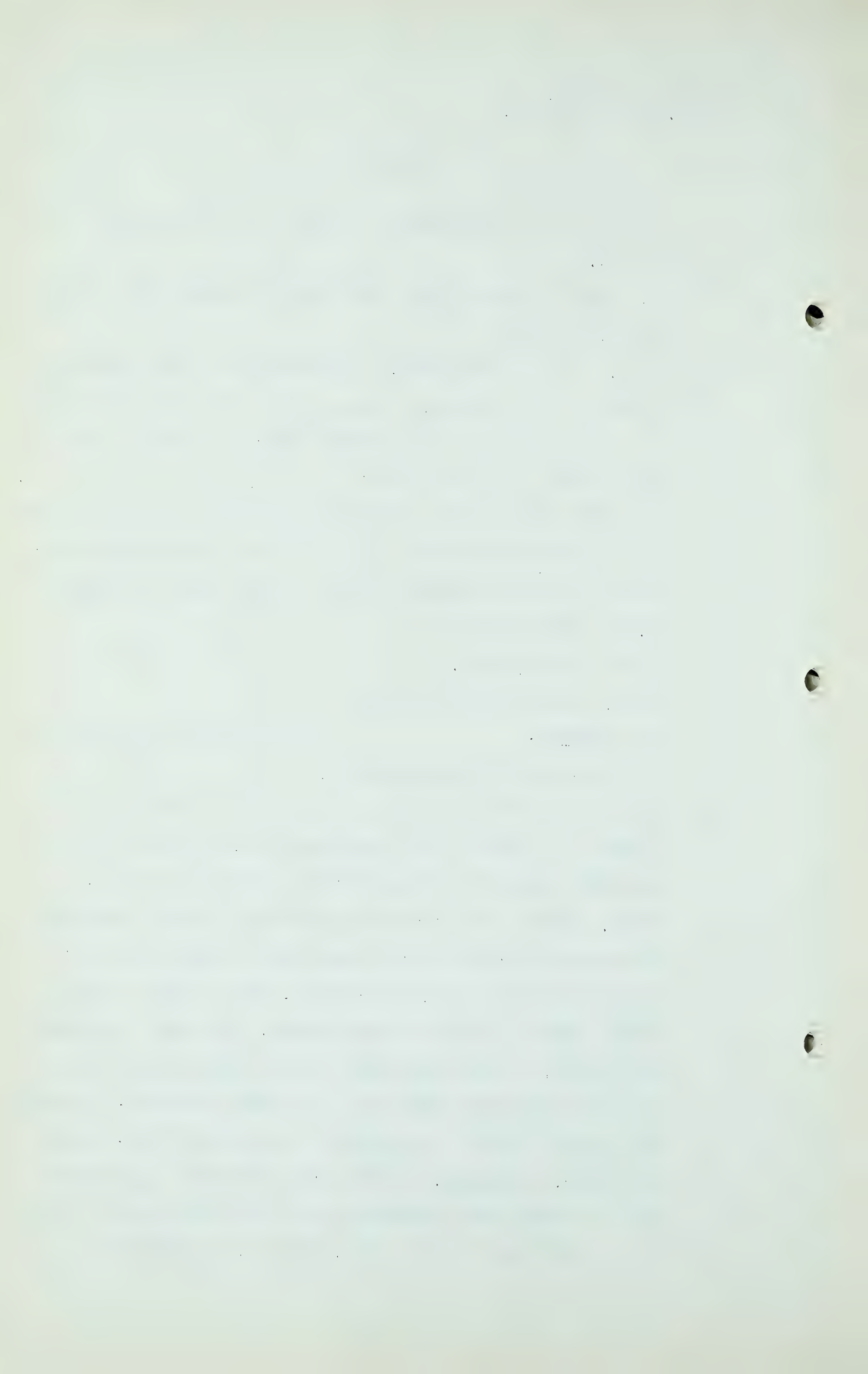
Q But with the present information and the present experience in the Lower Cretaceous you are of the opinion that somewhere around 160 acres per well is more realistic than 2,000 acres per well?

A That is my opinion.

Q Well, that is what we want.

Q MR. GOODALL: How would that work out on your acreage at Leduc-Woodbend?

A This is based on one thing I would like to call your attention to again, this American Gas Association, no reserves should be included from untested gas sands. Well, quite a lot of work has been done on the assumption that an electrolog proves a gas area. Electrologs are indicative rather than conclusive. In the Leduc field I think some 60 odd wells were tested. One area I assumed 960 acres. I think over half of the legal subdivisions in that area were tested and good flows obtained. Another 160 acres, a recent development in the North end. North Woodbend, so-called, it looks like there is a good indication if the Lower Cretaceous were fully developed. That is not only gas but also oil, but it is a matter of



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judgment and it is arbitrary as far as I am concerned.
I don't know how far these sands go.

Q DR. GOVIER: Have you used variable
figures such as these you have just quoted to me, Mr.
Liesemer, in going through and making estimates?

A Yes.

Q You have used 640 to 1,000 for the Colony sand?

A Yes.

Q And 160 in other cases?

A Yes. The Viking, I believe, I used 1,000 acres or 640,
depending on the area. For instance, near the Viking
field where the sand seemed better developed I think I
used 1,000 acres, and Ranfurly.

Q I was going to ask you about Ranfurly. Now you have
mentioned it perhaps you can tell me what you did about
Ranfurly. I notice Dr. Nauss takes a reserve of 32
billion today.

A This map would indicate the general area.

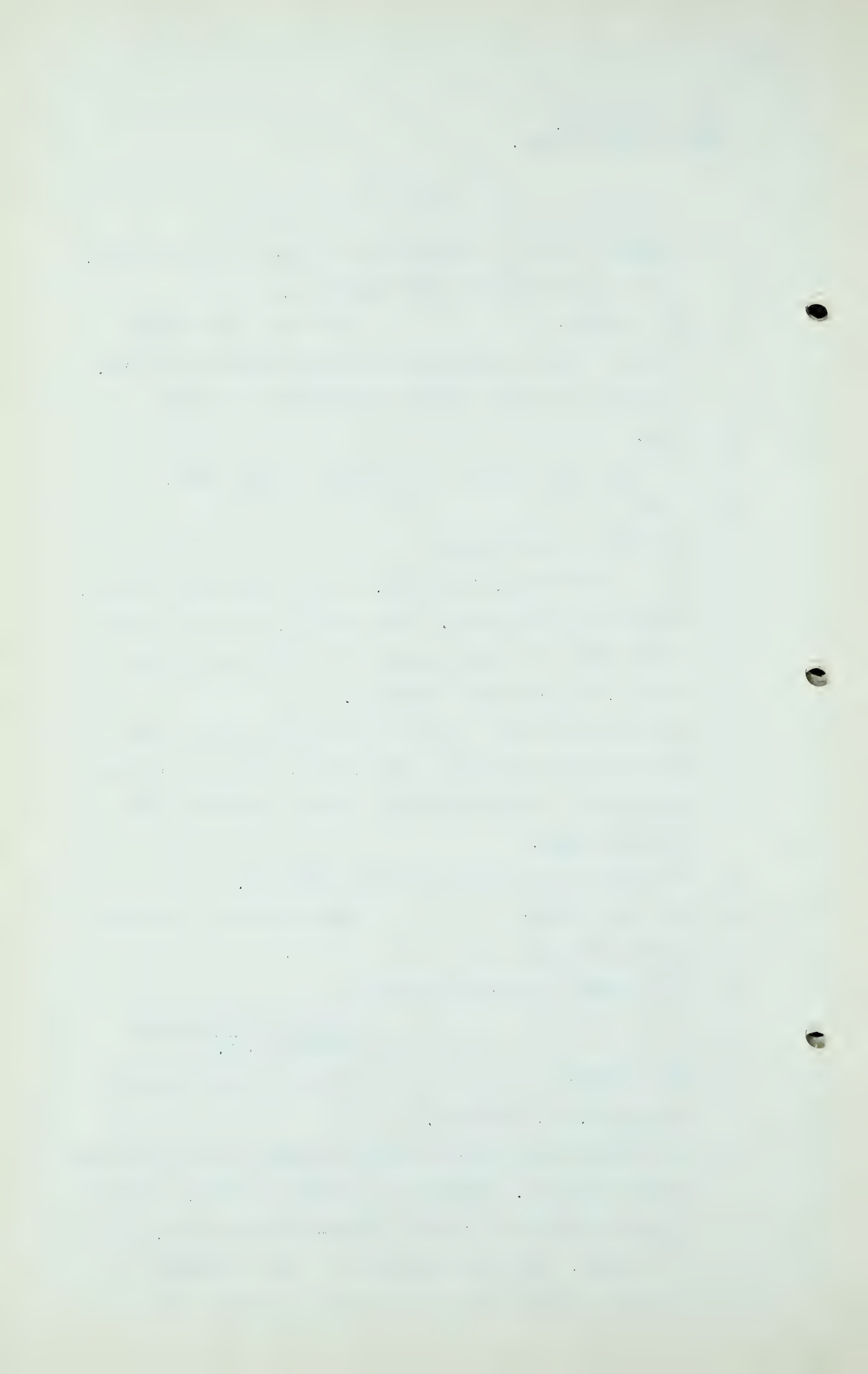
Q MR. C.E. SMITH: That map shows the wells
around it too?

A Yes, shows the wells around it.

MAP PUT IN AND MARKED
EXHIBIT J-46.

Q DR. GOVIER: Would you just explain
this then, Mr. Liesemer.

A The dotted line indicates what we think is the productive
limits, that is, commercial production limits. Probably
it is optimistic. And the Viking-Kinsella field, by way
of example, Imperial Consolitan, has a measured open
flow of a little better than 1 million feet a day.



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Q THE CHAIRMAN: That is the one on the north-west corner?

A That is the one on the northwest corner of the area outlined.

Q DR. GOVIER: How many acres would be included in this boundary?

A Well, these are townships.

Q Yes? Have you worked out the acreage, and would it be consistent with the figures shown on Table - I now notice you have not got a Table?

A No. I used the Imperial's plans.

Q Yes?

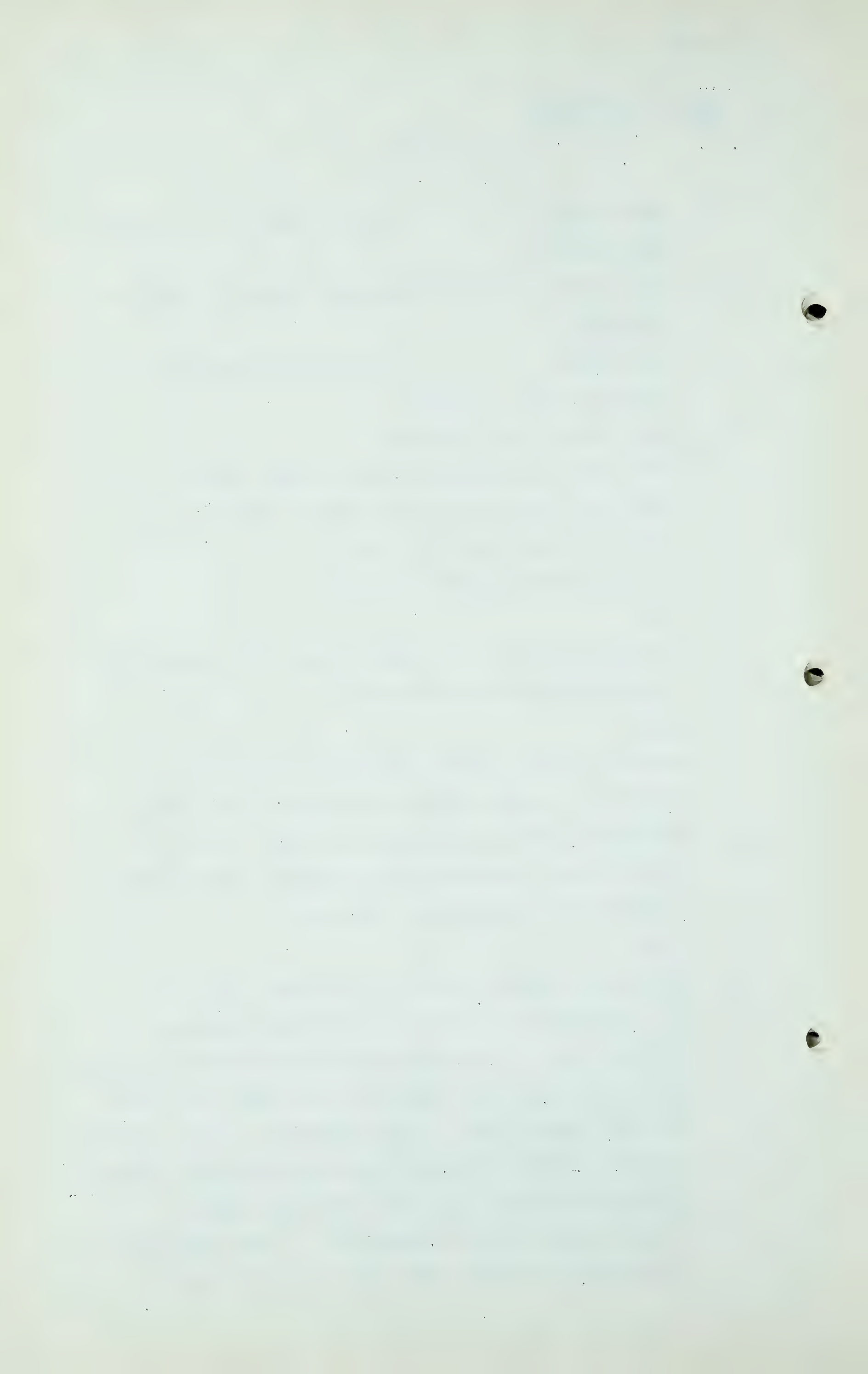
A But the perimeter measurements were used to work out the weighted average pressures.

Q Yes?

A And we took the Imperial Kinsella 10, the Imperial Number 21, a well drilled a good many years ago and abandoned without any production shown, the United Petroleum one near Birch Lake, that has been drilled and abandoned a good many years ago.

Q Yes?

A Now, the discovery well in the Ranfurly field is T. S. Ranfurly No. 1, that is the Toxaco-Superior Ranfurly No. 1. Since then they have drilled two other wells, one four miles nearer the railroad, the Texaco-Superior-Ranfurly No. 2, and south four miles, probably five miles southwesterly, they have drilled the Texaco-Superior-Ranfurly No. 3, and both had negative results, and they were abandoned. There might be approximately 10,000 acres there for all I know.



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Q Was Ranfurly No. 1 well a good well?

A I believe the production tests on it made about 6 billion, or 6 million feet a day. That is, I would not call it a good commercial well.

Q Well, in your consideration then of Ranfurly, how many acres did you allow to that?

A I assume 1200 acres in this particular case, a little better than two sections. I have not seen the seismic map. There is a high there, and possibly over the drop it is very high.

Q And you have omitted that?

A Yes.

Q I notice, Mr. Liesemer, that there appear to be some abandoned wells right within the Viking-Kinsella perimeter, am I right there?

A That is right.

Q I am right?

A Yes.

Q The No. 9?

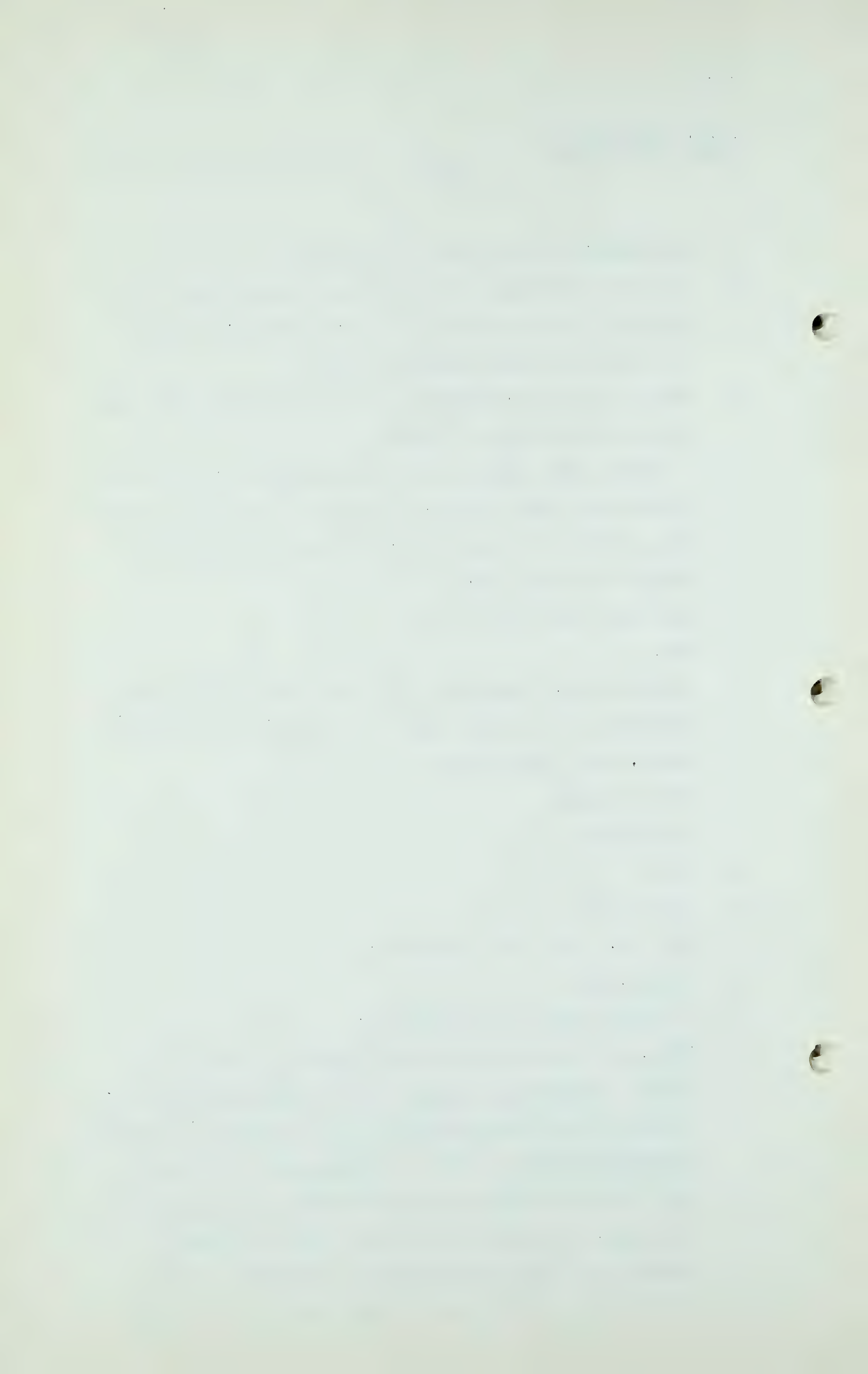
A Yes, No. 9 has been abandoned.

Q And No. 21?

A I believe that is correct, yes.

Q Well, can you come to any conclusion as a result of that? Is there any possibility that this Ranfurly No. 3 might also be an abandoned well, in the heart of the producing field, or are the circumstances different?

A Well, from the nature of the reservoir itself, what happened, it seems that the good sand is slightly shaling out taking it towards the periphery of the field, and I am inclined to think that is an outside



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chance that you mentioned.

Q Well, how do you explain the fact that well No. 21 would not be a producer, whereas well No. 2 is a producer, and they are close to each other?

A Well, none of the Viking-Kinsella.....

Q MR. GOODALL: Probably 21 did produce?

A Yes, I was going to say, I believe it did produce for a few years.

Q DR. GOVIER: Oh, I see.

A The general average open flow of the Viking field is considerably less than the Kinsella portion to the east.

Q That is fine. That is all I wanted to ask you about Ranfurly, Mr. Liesemer.

A Yes.

Q Let us go back to your Exhibit 41?

A Which one is that?

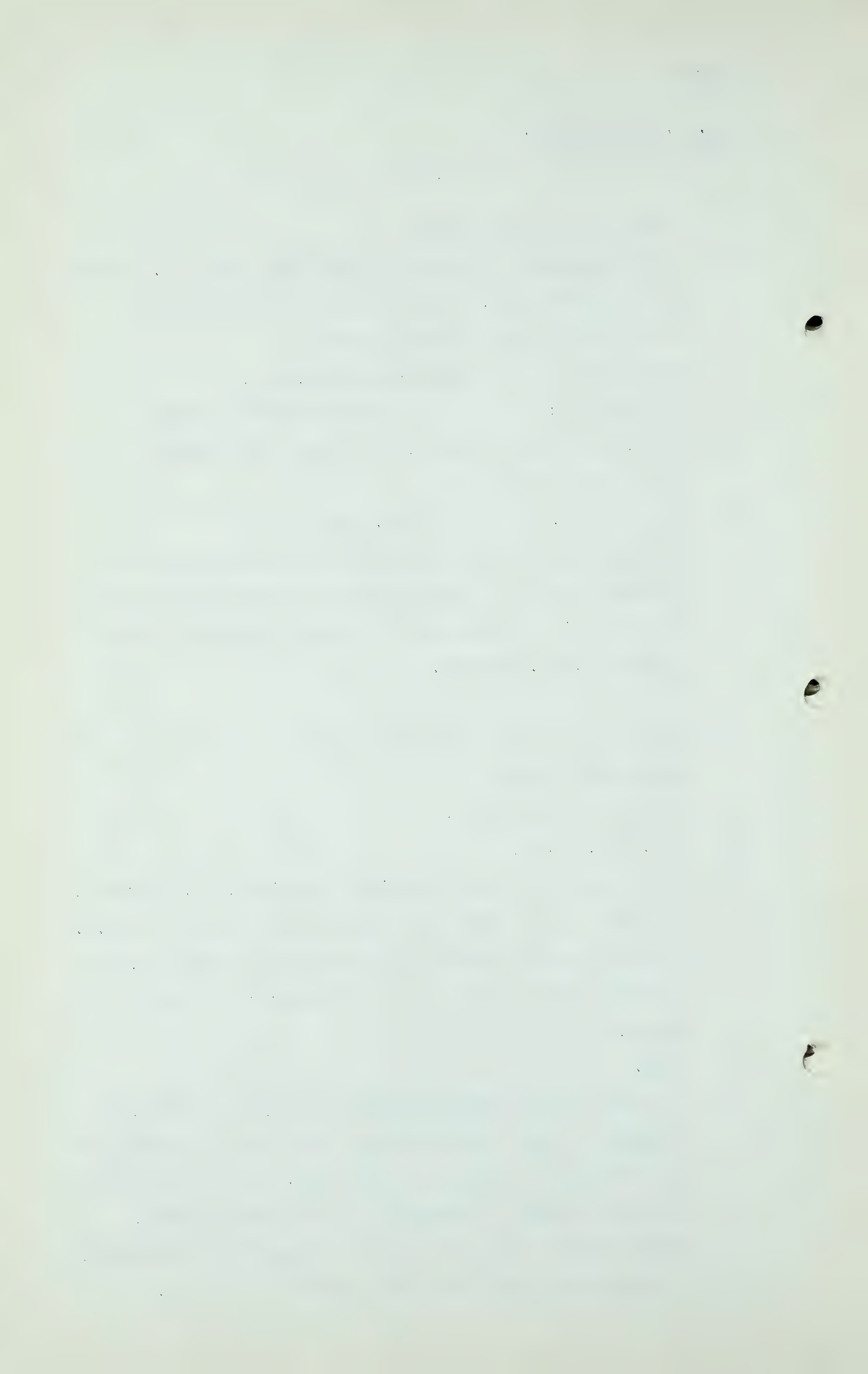
Q That is the main one.

A Oh, yes, I see.

Q And I think you have certainly explained, Mr. Liesemer, in what way you agree with and disagree with the A.G.A. Committee on the curves and your general approach, and you have told us that you have arbitrarily - this is on Page 1?

A Yes.

Q "It has been arbitrarily assumed that, in general, any reserve of less than 20 billion cubic feet of marketable gas cannot be economically gathered. This is believed to be a reasonable assumption at the present time, particularly in view of some of the previous testimony." I had several questions with regard to that, Mr.



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Liesemer, but first I wanted to ask you whether you had made any study of your own on the economics of gathering gas in this Province?

A No, I have not.

Q What major factors do you think would enter into the problem of economics of gathering gas from a field located X miles away from a market?

A The size of the field and the cost of the X miles of pipe line, and the necessary charge per MCF transportation that we have to have to amortize the cost of the pipe line.

Q And the pressure at which the reserves are at?

A Yes, that would enter into it, whether we would have to start from scratch with a compressor plant or operate into the line direct.

Q Would it be fair to say, assuming average pressure and depth, and gas property conditions, that the two most important factors would be the size of the reserve and the distance away from the market?

A That is correct.

Q Those would be the two most important things?

A Yes.

Q Well, then, the thing that I do not understand, Mr. Liesemer, is how it is that one can arrive at a rule of thumb, and, I take it, that is what your 20 billion cubic feet is?

A That is the only reference I could find in the Smith-Wimberly Report.

Q But it makes no reference to distance whatever?

A No.

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Q So that it makes no difference whether you assume a well with a billion reserve, whether it was a mile or a hundred miles away from the pipe line?

A I am thinking of the previous testimony, I believe in the testimony of Mr. Lewis, I believe it was, he gave 1 mile for 10 billion cubic feet required, and that is the rule of thumb.

Q Did you use that rule of thumb in addition to the 20 billion reserve?

A I thought in the light of his testimony you had to be within a mile for 10 billion that the De Golyer statement would be a safe working rule.

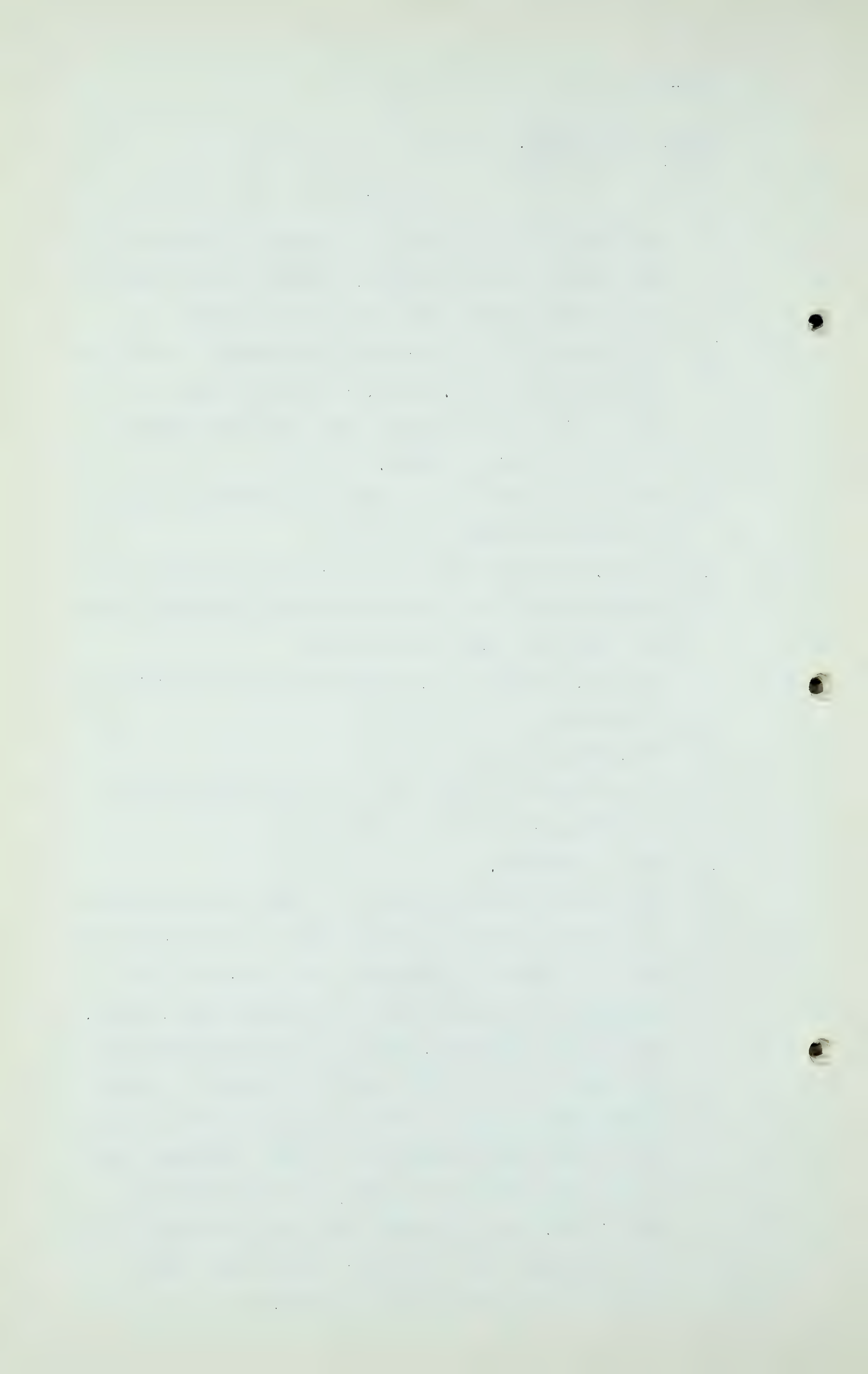
Q In fact, you give in Appendix 2B the origin of this reference?

A Yes, that is correct.

Q Let us just read this over. You say, and this is a quotation, I take it, is it?

A That is correct.

Q The number and minimum size of fields to be included are awfully important considerations. Since each field must be studied individually, it is generally not practical to include many of the small fields, which, even in the aggregate, would not increase materially the amount of the total estimated reserves. In his comprehensive reserve estimate, De Golyer limited the size of the field considered to those believed to have 20 billion cubic feet or more, which includes some 486 fields." Mr. Liesemer, from that statement do you get the notion that De Golyer adopted that rule of thumb to save himself a lot of work, or do you get



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the notion that he took that rule of thumb because of the economics of the gathering of gas, taking a small reserve?

A I have no idea what Mr. De Golyer had in mind, but I imagine a little bit of both.

Q I suppose so, but would you agree with me that any rule of thumb which makes any reference whatsoever to distance, the gas must be moved, is an incomplete rule of thumb?

A That is correct.

Q To say the least?

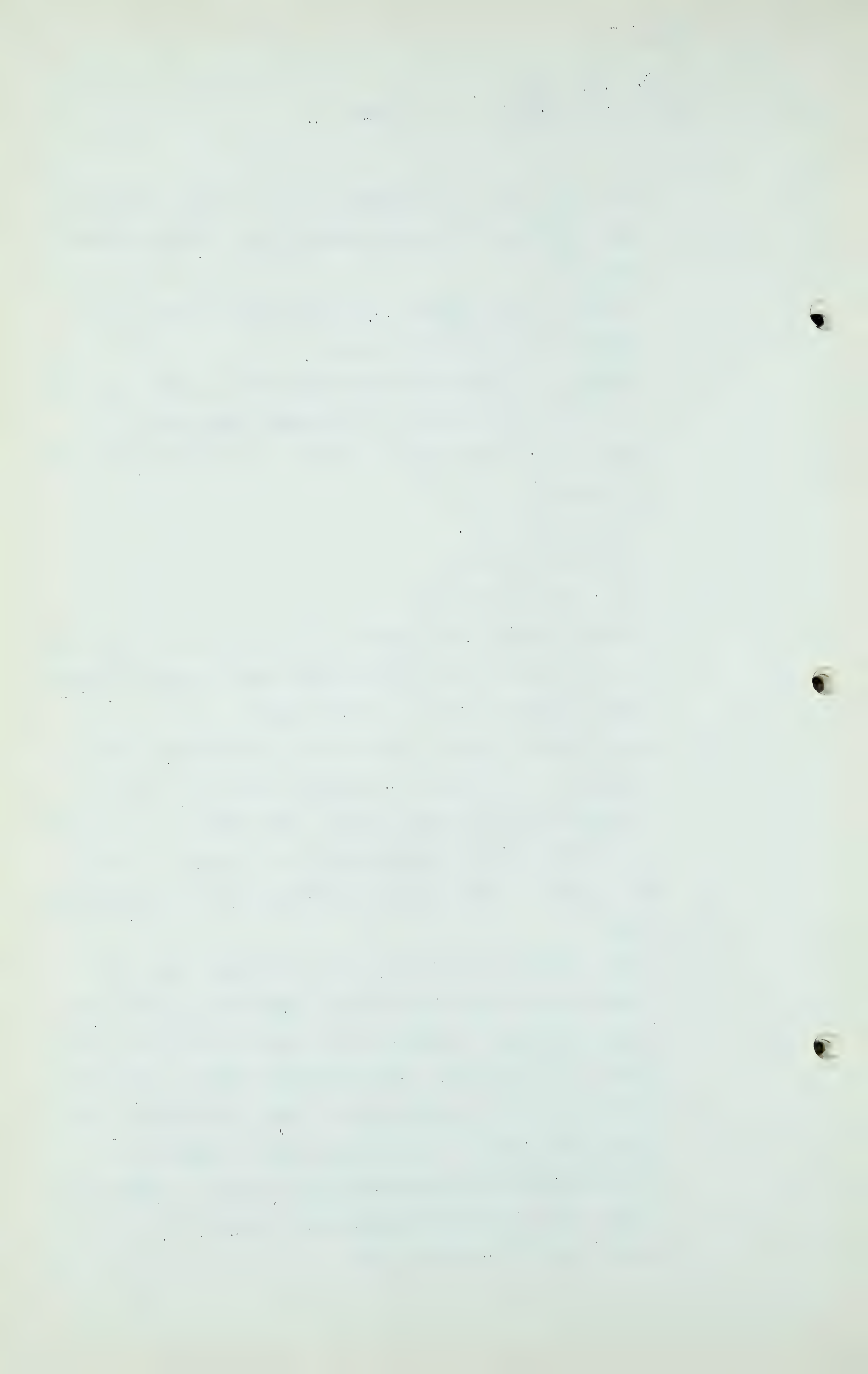
A Yes, that is correct.

Q But you believe, nonetheless, that this 20 billion rule of thumb is not too inconsistent with the one Mr. Hawthorn suggested to us, is that right?

A Yes, that is right. Let us take the Ranfurly, for example. My personal - I am not too sure, but I can check with the Gas Company, why Number 9 and Number 10 and well 21 were abandoned, but I imagine it would be because of the low productivity as much as anything.

Q Yes?

A Now, Imperial Kinsella No. 10, I am quite sure will never be connected with the gas gathering system for years, because of the fact that having 1 million cubic feet a day open flow, that probably would be 100,000 or 200,000 on the line pressure. Now, the Ranfurly well must be at least 10 miles away from the top end of the Viking-Kinsella gathering system, and I should say there they must have a substantial reserve to go 10 miles with a four-inch line.



Q Although it is a reserve which you now say you might have included?

A Yes.

Q Under reserves beyond economic reach?

A Yes.

Q Well, in your opinion, it is a reserve that has little importance to the problem that the Board has before it?

A That is correct. That is my view in omitting a number of the smaller reserves.

Q Just while I think of it, Mr. Liesemer, that means then that on your Table where you make the final summary, this Table here (indicating)?

A Yes, I cannot find my copy of that.

Q MR. C. E. SMITH: I have got it here. This is your copy.

A Thank you.

Q DR. GOVIER: At the bottom of the Table you have under Note 2, "Beyond economic reach to pipe line" etcetera, 191 million cubic feet.

A That is correct.

Q Am I right in assuming that that figure really should be increased by an amount which is indicated by Exhibit 45?

A Yes.

Q That is right?

A If you wish to, yes.

Q No, I want to know what you wish?

A I will conform with that, that will conform with my wishes also.

Q Now, I see one difficulty here, and that is Exhibit 45

G. E. G. Liesemer,
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gives the gas in place, doesn't it?

A Yes, that is correct.

Q And this is 191 feet of gas which would be marketable if it were within economic reach?

A That is correct, yes.

Q Perhaps you could indicate to us how we might change and revise this 191 figure?

A The 191?

Q Yes?

A If you could increase that by about one-third, we had an amount, let us say, 191, and then there is 79 of which 116 is in place, and then 87 of which 119 is in place. And what is the other one now? Oh, yes, 25 and 35, that gives 270.

Q You would increase it by 270?

A Yes, that is in place.

Q Oh, in place?

A Yes, as against the 191 assumed to be marketable.

Q Well, I am afraid you have lost me, Mr. Liesemer, will you go over that again?

A O.K. This 191 is made up of three items, the first one being Provost, 79 marketable of 116 of place.

Q Yes?

A The second one is made up of the Sunburst at Princess, which is 87 marketable and 119 in place?

Q Yes?

A And the third one is the Princess-Devonian, 25 marketable and 35 in place. And then you add 116, 119 and 35, and get 270 as against 191.

Q You get 270 and then you would add that 270 to the total

G. E. G. Liesemer,
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figure given in Exhibit 45?

A Oh, no, this 116, 119 and 35 were included in my figure of 5786.0 in Exhibit 45.

Q Well, I am not in very good form this morning, Mr. Liesemer, I still do not follow you. Suppose that we wanted to obtain from you a revision of your Category 2, which is entitled "Beyond Economic Reach of Pipe Line", and we wanted that revision in order to include these little ones.....

A Oh.

Q which you have thrown out because they are not within economic reach, but they really belong in that category, do they not?

A That is correct.

MR. C. E. SMITH: That is J-45, is that what you are talking about?

A This is by rule of thumb again.

Q DR. GOVIER: Yes?

A Take the first total of 365.7.

Q Where?

A In the exhibit.

Q I have it.

A And so we take 75% of that.

Q All right?

A Goes down the line?

Q All right.

A And then you take the two.

Q This 270 would be close enough, would it?

A That is close enough, yes.

Q Yes?

G. E. G. Liesemer,
Exam. by Dr. Govier

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A And if you wish to you can include the Morinville and the Princess Basal Colorado.

Q What would your recommendation be?

A We felt that we could not make a reasonable estimate there, and I would be prepared to assume or take Dr. Hume's estimate, if you wish to do it on that basis.

Q Was his estimate based on an acreage which you feel is reasonable, or was it based on the 2000 acres?

A It was based on the assumption that two or three wells were in the field, and I think it requires much more drilling to prove. Incidentally, when I say "I", I should say "we". Mr. Crockford and I reached that decision jointly, and we feel that in the Princess Basal Colorado where they have two wells, two or three wells, that that does not actually decide it.

Q I know Mr. Goodall has some questions that he wants to ask about that, so that let us leave out Morinville and Princess for the time being?

A All right.

Q You got this 270 figure, and you would add it to the 191?

A Yes, and also to the 3635.

Q I see. And what you would be doing then is you would be making this category "beyond economic reach of pipe line " all-inclusive?

A Yes.

Q And it would include even the reserves less than 20 billion?

A Yes.

Q Which previously you had left out because you thought that there was no chance of that reaching the line?

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Q

A Yes.

Q

I see. On Page 1, Mr. Liesemer, you have reference to previous testimony, is that with reference to Mr. Hawthorn?

A

I believe Mr. Lewis is the man.

Q

Mr. Lewis?

A

Yes. That is his rule of thumb, 1 mile.

Q

1 mile for 10 billion, was it?

A

I believe that was the rule.

Q

Or 1 mile for 1 million per day?

A

Yes.

Q

Incidentally, that 1 mile for 1 million per day would be consistent with your view that Imperial Kinsella No. 10 could not be picked up?

A

That is right.

Q

Unless they had the line for other reasons?

A

Yes. Assuming all the small fields could be connected, if they follow the trend, and there were a number of fields along the pipe line.

Q

Yes. Now, I see on Page 1, Mr. Liesemer, in the third from the last paragraph, you say, "Where the porosity area method was used, a deduction of 10% was made from producible gas to arrive at the amounts marketable."

A

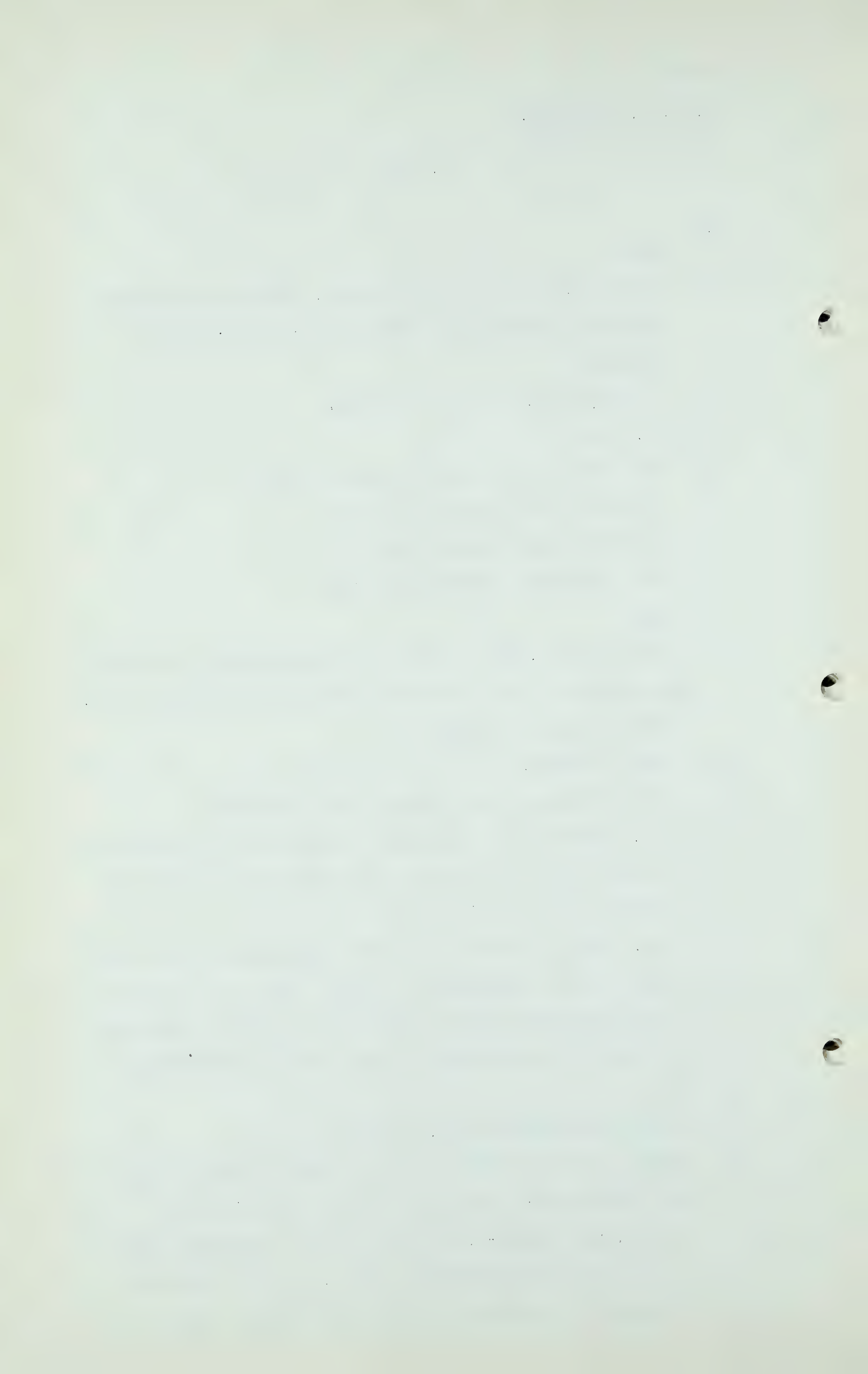
Yes.

Q

Would you explain that, please?

A

Well, I made one calculation on that. That is the only place where I was able to make any kind of a check, was Viking-Kinsella. It is a difficult point to say how much gas is being lost. I used the term "wasted", it is wrong, it should be field losses in



G . E. G. Liesemer,
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the case of normal operation. I will submit this check that I made, I will do it for your consideration. It does not have any particular method, but it is the only thing I could do to substantiate the figure I was using.

Q Those were waste really, that is what you say?

A Field losses.

Q Field losses?

A Yes. I think that is probably a better word.

THE CHAIRMAN: That will be Exhibit J-47.

DOCUMENT ENTITLED "FIELD WASTE -
VIKING-KINSELLA" PREPARED BY
MR. LIESEMER, MARKED EXHIBIT
J-47.

Q DR. GOVIER: Would you explain that?

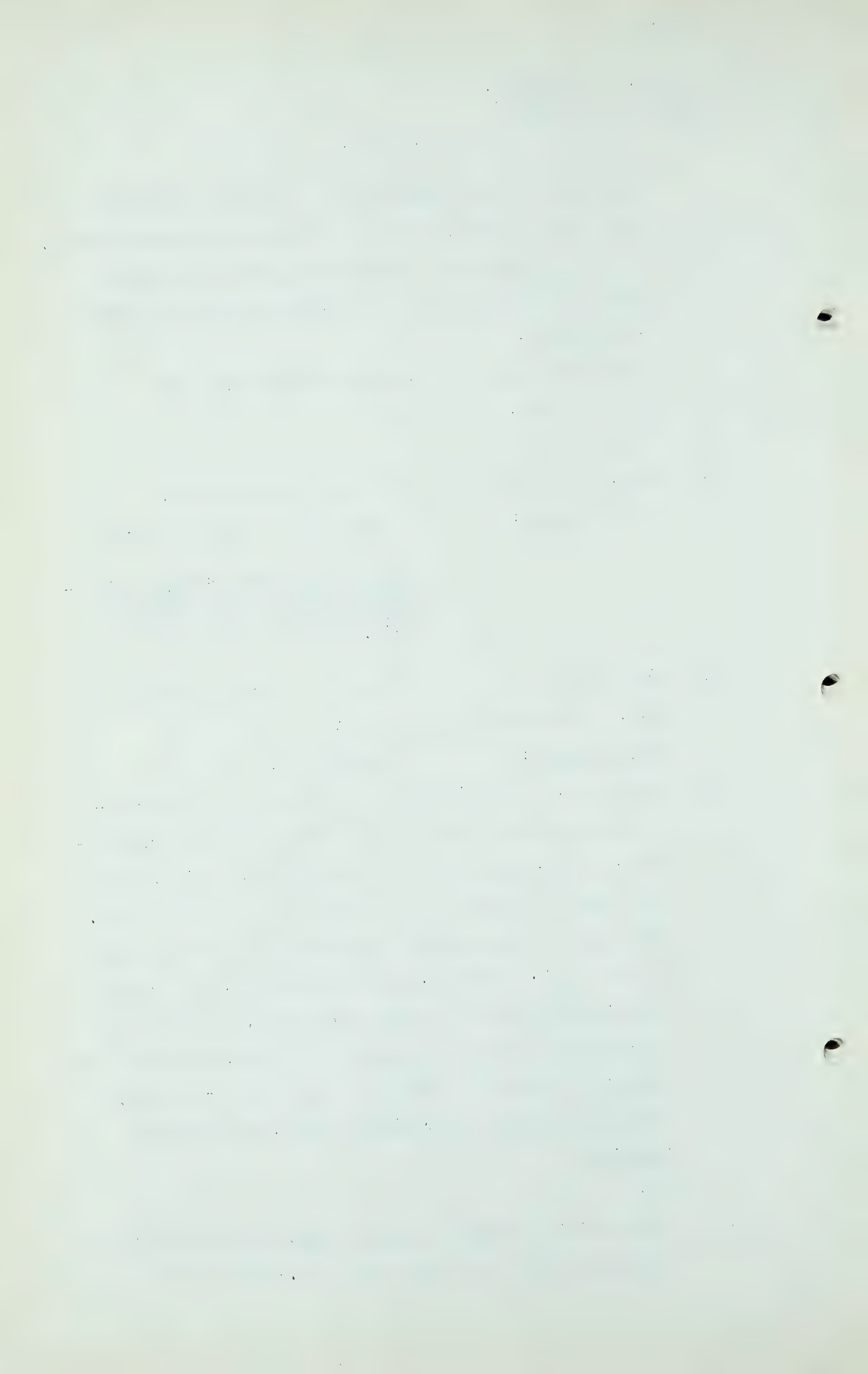
A Yes. Did this have a number?

THE CHAIRMAN: Exhibit 47.

A Thank you. Imperial used a porosity area determination in their check on the material balance calculation. Now, this dates back from 1946, or '47, the year that you might say that they outlined the field. They made a very careful appraisal of the Viking sand in that area. Like Mr. Davis suggested, they cored the acreage into five different groups, and they came up with the average thickness of 15 feet, and used that average thickness to estimate these various groups. They came up with a porosity of 18% , the average porosity.

Q Yes.

A And an average connate water of 45%, and the total effective pore space came out to 20.4927 billion



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cubic feet.

Now, I refer you to Appendix No. 4, I believe it is, that we attached, that we used, and that gave the gas realized per cubic foot of pore space at 7.99 cubic feet. That would mean that there had been produced up to the time they made the material balance calculation 163.637 billion cubic feet of gas compared to the measured production of 127.501 billion cubic feet of gas. In effect, this means that 22.08% of the gas produced was wasted or lost, that would be a better word for it, at least.

(Go to page 945)

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Now, Mr. James O. Lewis stated in Volume 3 at page 254 of the Western Pipe Line hearing that if you came within 10% that is pretty good. Assuming therefore that the Imperial measurements are 10% too high that would still leave 13.5 of the total gas produced being lost. However, it must be kept in mind that the total production figure of 127,501 MMMcf. includes some of the waste or lost production that can be measured with a reasonable degree of precision such as annual open flow tests. Say the odd instance where a well becomes heavily water-logged and where they blow it for 6 or 10 hours and take spot readings from time to time. Those figures are recorded and are reported to us as waste. I do not believe there was any serious blow-down in 1947. Now these years have been reversed. It should be 1949, 1948 and 1947.

Q The middle one is all right?

A Yes, the middle one is all right. In other words, the difference between 1946 and 1947, that is the annual test in 1946, the blow-down period was 1 hour and in 1947 they changed over to a half-hour blow-down period. That gives you some idea of how the pipe line loss figure like that can accumulate when by just blowing down a well, as I have shown you, would account for 1.29% of the year's production. Therefore it appeared to me that a 10% deduction for loss between producible and marketable gas in the Cretaceous sand field is both just and conservative. And I do not think you will find a field that loses less in this Province than does the Viking-Kinsella.

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Q Whether the reserve is a wet gas reserve or a dry gas reserve you have added to the known shrinkages and so on this 10%?

A Yes.

Q Mr. Liesemer, does this Exhibit 45 contain a list of all the small areas which have been mentioned by various witnesses which are not included in your Table?

A I do not believe it does. This report of Dr. Hume's was up to about June. I have not got Dr. Nauss' Table here. Dr. Hume has nothing on Ranfurly.

Q MR. C. E. SMITH: And he had never heard of Whitelaw I do not suppose at that time?

A That is correct, he had not heard of Whitelaw. I do not know of any other offhand. Joseph Lake, he mentioned it but Dr. Hume did not give any reserve figure there. There may be some others but offhand I cannot remember what they are.

Q DR. GOVIER: On page 10, Mr. Liesemer, I assume this is just a typographical error where you have formation pressure at -8079, that should be formation temperature, should it?

A That is correct.

Q Formation pressure, you do not list it separately although you use it later? It is 4943?

A That is correct.

Q And as I recall your explanation yesterday the principal difference between your estimate and the Gulf estimate is due to acreage?

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A That is right, and a higher abandonment pressure. I think I use 700 pounds.

Q Acreage, abandonment pressure and also you used a higher discount factor?

A Yes.

Q There are three factors that enter into it?

A That is right. Then other things enter into that. Well, I don't know that it is important so I will just drop it.

Q On page 14, the last sentence in the first paragraph: "Therefore assuming a 30-year life for the field there will reach the plant in that period a total of 30 plus 365 plus 18 million cubic feet?

A Yes, the plant capacity.

Q 18 is the plant capacity?

A That is correct.

Q So I take it you do not expect that the capacity of the plant will be increased even to the rated capacity of the processing equipment that I understand is 2400.

A That is the only firm statement that the Imperial Oil engineers would give me. I wanted to know what was to be done with the production of gas in the Golden Spike and they had no information on that. They had no information of the extent to which the return fuel lines were to be extended all over the field and things of that nature, but they were quite sure that within the predictable future there would be no extension to the absorption plant. That is one place I could hang my hat on.

Q Do you think you could revise this statement in view of Mr. Mackenzie's statement here?

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A I do not think so. I have not attempted to do it. Where I got myself into difficulties was making a computation between what you might call marketable reserves and probable reserves.

Q I think Mr. Pot had difficulty there?

A Yes, he had. That is what I tried to do. I assumed during the foreseeable future, and I made it 30 years, assuming that to be the terminal point for oil production that any gas that was not going to be sent through the plant would be repressured at Golden Spike.

Q If the plant capacity were increased to 24 by Imperial a little later on, or even to 27 million, which I think Mr. Mackenzie stated was possible, your 197 figure would be increased tremendously?

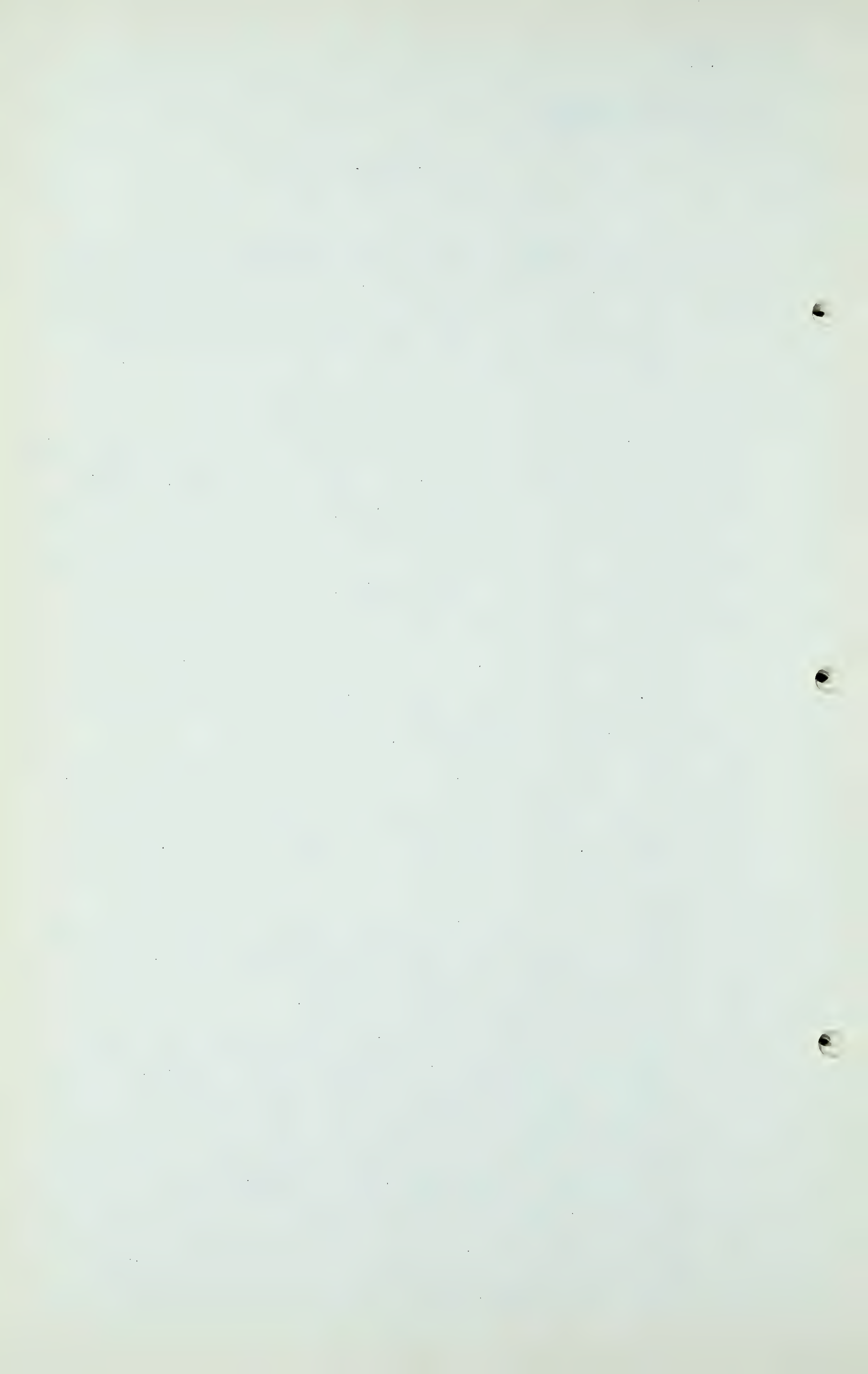
A Yes. Of course we will have 27 and you lose about 3 for shrink, that is 24, and we have assumed 4 million down the line, that would make 20 million. That is just what I was figuring.

Q Then the 131 would go up in the ratio of roughly 20 to 12?

A That is correct. It would work out about 216 million.

Q So we have found a little more gas?

A Well of course if the break-through expected by various engineers takes place it could be almost anything. I had assumed possibly somewhere in the West side of the field, along the river, they will find a well that if they wanted to take more oil out they could be pumping 10 or 15 million barrels of water into the formation and so would hold their gas cap, which I think could be done. As an effective sweep for recovery, water is much more effective than gas.



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I think water could be pumped from the well at the river bottom and that you could maintain your pressure much more cheaply by that means than by injecting gas into the gas cap.

DR. GOVIER: Those are all my questions, Dr. Liesemer.

EXAMINATION BY MR. GOODALL:

Q I have a few questions, Mr. Liesemer. Dr. Govier has covered some of them. I was wondering, you have a map on the back of Exhibit 40 showing the general Morinville area and the Excelsior field. Now I believe I did see a cross-section but that was probably - -

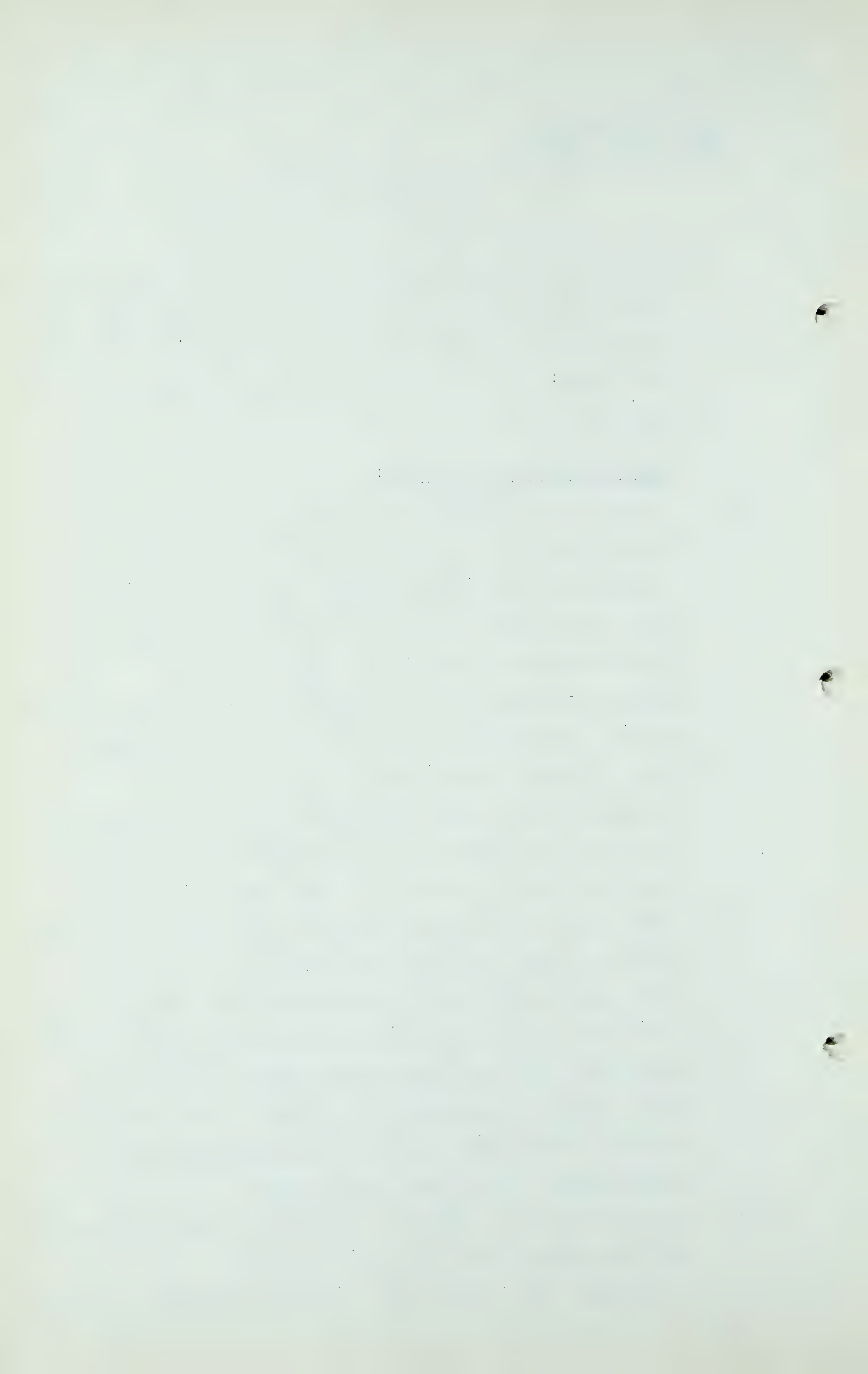
A The cross-section of the Excelsior field, that is Mr. Crockford's. He proposes to deal with that at great length. That is the way we divided our work.

Q In your analysis of gas occurrences in the Excelsior field, you told of the results of a considerable number of drill stem tests which indicated a rather erratic condition in that field. This field was rather close to the Morinville wells and I was just wondering what your thoughts are if that condition is likely to extend over that entire area?

A It is only less than two miles distant but I would hesitate to say that you have a continuous field. I believe the whole thing is susceptible of proof but it will take more drilling. My feeling is it is more capable of being disproved as a field than being proved.

Q If we assume that condition is general, it could be drilled out economically for gas alone?

A I prepared, and I submit this with some hesitation because



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I do not like to get tangled up with geology too much, but I took one well, probably the best one naturally, that is the one that had the longest section of the Lower Cretaceous sand, and I set it up against a cutting taken from a text book or a manual, you might call it, "Subsurface Geological Methods", Leroy, you will notice there that he defines - - it is simply a means of interpreting the electrolog. That is all it means. "Gas sands may show a high resistivity and relatively low natural potential." That is what I call the self-potential on the Schlumber J log. Salt water sands are characterized by low values on the deep penetration resistivity curve. I am informed by the gentlemen who make these logs that that is equally indicative of water, a sharp break-off to the left on the self-potential. In other words the two things give you an indication of water. On this Imperial Morinville well I have bracketed on the side of it to show the various drill stem tests, a continuous series of drill stem tests through this Basal Quartz strata, beginning at about 1510 feet down to the water line that looks to be about possibly 3580 or thereabouts. In effect, what has happened there is there are a number of shale breaks, that is those indentations to the right on the self-potential, indicating you have not got a continuous sand body. Instead of having a sharp break-off in your self-potential indicating the water line, you have a long gradual break which would indicate that instead of a true water table developed sharply, you have a long transition zone and that is what

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would make me hesitate to say that you could count on a gas well with the wells we have picked up in this particular area.

Q DR. GOVIER: Would you go over that bit of reasoning again?

A You mean the idea of the transition zone?

Q Yes?

A You do not have a sharp break-off on your self-potential but there is a long slope with indentations that go with shale breaks.

Q At approximately what depths?

A I would say from 3530 down to your water line. There are three shale breaks indicating that the water content is increasing.

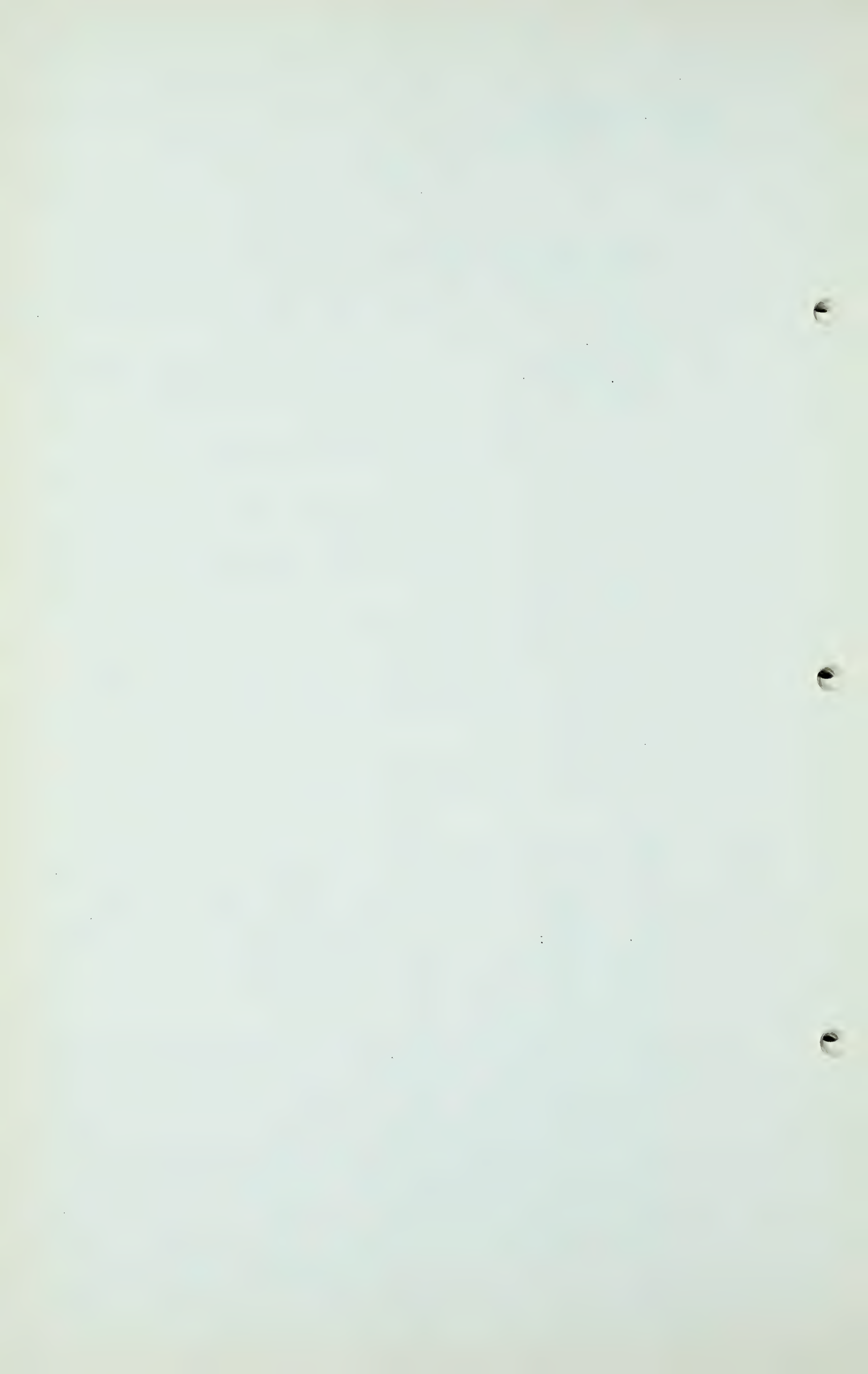
Q By reason of the dip to the left?

A Yes.

And in other words, rather than a definite sharply-defined water table I should say there is a transition zone.

Q DR. GOVIER: If that had been the case why would not there have been water produced on some of these drill stem tests?

A The period was too short. None of these wells have been what I would call adequately tested. Now the completion procedure would have been to perforate the top 5 or 10 feet and stay away as far as possible from that transition line. Had the well been completed in that manner and been blown for 10 hours you might have found out a water drive. Now, it is not physically impossible to produce that type of well. We have an instance of that



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of Mr. Yeats of Lloydminster in the Colony Sands. They have bottom water in all those wells and I think his present pressure is 350 and he operates with a bottom hole pressure of 325, but with a terrific sacrifice in deliverability. He does not take more than 200 or 300 thousand a day on those wells which had an initial flow at 30 million. My feeling in the matter is that although these things are possible I would hesitate to say to you that you could have a really good commercial well. That is not my own evidence in the matter. I submitted this problem to a number of men in my own business and while they felt like I did, that we will not know till these things are tested, they all agreed with me that in order to produce these wells you would have to perforate at a very high level and stay away from that water as far as possible, and produce the wells gradually.

Q MR. GOODALL: Have you compared this log with any other wells on production or has there been any production?

A I do not know of any of these wells that have been on production where we have an indication of a transition zone. I believe there is an Imperial Well at Redwater, 71, that is not producing from the Quartz member, I believe it is producing above the ostracod zone.

Q You gave a reserve for the Lower Cretaceous at Leduc-Woodbend?

A Yes.

Q Assuming the same condition existed in this area, the Morinville area, do you think it could be developed

G. E. G. Liesemer,
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without the assistance of oil production, that is, developed economically?

A If the proposition were placed before me by someone that has money to invest, I would hesitate very much in recommending it. I do not know but I wish these wells had been tested with a 10-hour blow-down, just one for instance, and give us some way of knowing whether there is a real danger of that water coming in.

Q What I was thinking of was that you would have to drill a number of dry holes to outline your producing sand?

A Yes.

Q Which is naturally done in an oil field where they are drilling for oil?

A Yes.

Q And I was wondering if you considered the economics of drilling wells and deliverability and gathering costs and if it would be economical to develop such a field?

A There are so many factors enter into that. My first guess would be no. I would hesitate to try. If, on the other hand, this transition zone is no impediment to the producing of gas when you consider you have 1300 pounds pressure, or a thousand, I am not sure which, we have a really good bottom-hole pressure and you have an 80-foot gas sand and your reserve per square mile would be so large you could afford to drill a dry hole. If, on the other hand you found production and you found that water became a problem very early, you would have to operate at a high back pressure to get away from the water and your deliverability would be very low. You would not have an economic proposition on your hands.

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Cr. Ex. by Mr. McDonald.

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Q I think I have covered everything there, Mr. Liesemer, that I had in mind. There is one thing on page 7 of your submission.

A Yes, sir.

Q There is one thing I do not understand here on this last page, at the bottom of the page.

A Oh, yes?

Q Are those recovery percentages and marketable estimates Hume's?

A Yes. I used Dr. Hume's figures for Saskatchewan and the Lloydminster side. I thought to keep the picture consistent I would use his figures all the way through. I used 60% for wells that are partially depleted and 75% for the two wells 4 and 11 which have just recently gone on production.

Q That is what I was referring to, the recovery?

A All of Dr. Hume's figures, or practically all of them, are gas in place.

Q But the percentage recovery?

A That is my own thinking on the matter, yes.

Q And the marketable is yours?

A Yes, that is correct.

Q I see. Thanks, Mr. Liesemer.

CROSS-EXAMINATION BY MR. McDONALD:

Q Mr Chairman, I have another question, if I may. Dealing with this Morinville electrolog, Imperial Morinville No.2, I think the log Imperial Morinville No.1 is in many respects similar?

G.E.G. Leisemer,
Cr. Ex. by Mr. McDonald.

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A They are very much alike.

Q What have you to say in this statement in Exhibit 3 in the Westcoast Transmission case, that is, the first report of Dr. Nauss, it says:

"An examination of the electrologs shows 50 feet of sand on the top of the Basal Quartz upper as containing gas."

That correlates to what you have here in your Exhibit J-48?

A There are several shale brakes, as you notice there, Mr. McDonald, and the full core section would answer the question but I think 50 feet.

Q "This sand is separated from the main mass of sand body by a thin marine shale bed and the entire sand above this shale bed apparently contains gas."

A Would you read that again?

Q "This sand is separated from the main mass of sand body by a thin marine shale bed and the entire sand above this shale bed apparently contains gas."

Now, I do not want you to deal with the point of the entire sand above the shale apparently containing gas, but do you agree that this sand is separated from the main mass of sand body by a thin marine shale bed?

A I do not know that. There are shale bands through the sand.

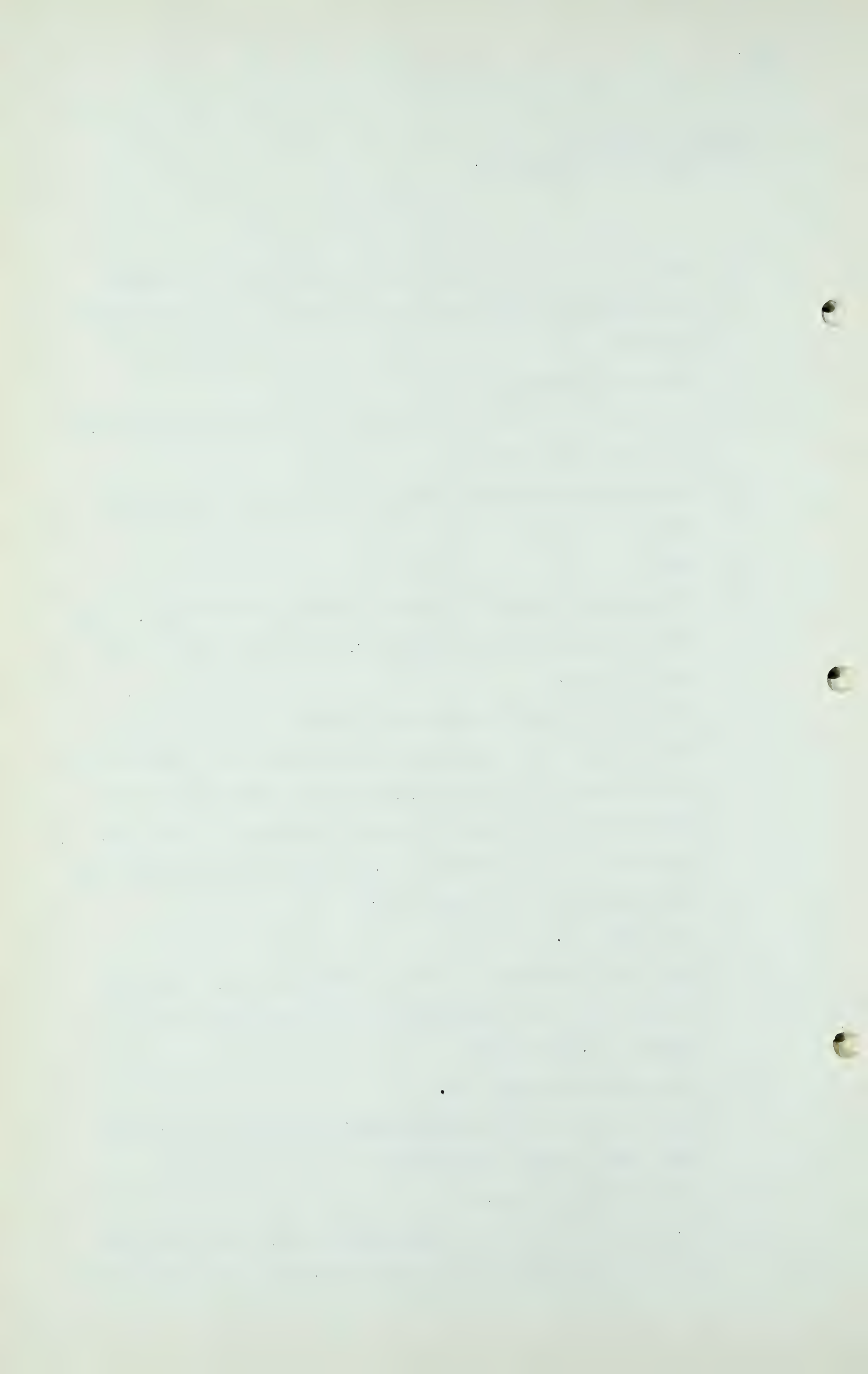
Q Doesn't your electrolog show that at approximately 3580 feet there is a change in formation?

A That is right, yes.

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- Q Now, is it not entirely possible that there is a shale bed separating that salt water from your producing sands above?
- A That could happen.
- Q Yes, and if it did then that salt water would not be in the producing sand?
- A You mean you could set pipe and cement pipe and shut it off?
- Q Yes?
- A It could be done but I do not know how effectively. They have tried that at Lloydminster, you know, with not too much success.
- Q What I am trying to point out and place on the record is that if that shale bed can be ascertained and the drilling can be made to set on the pipe above or through it and perforate it that the salt water indicated by this electrolog which you have shown as J-48 would not interfere with gas production from that field?
- A That could be.
- Q Now, I was interested in your statement, too, that you did not know of a Lower Cretaceous field which had an extent of 2,000 acres?
- A One continuous sand, yes.
- Q Now, do you include this Excelsior section of the Morinville area in that statement?
- A I gave it 1600 acres.
- Q Now, you notice in this submission, J-29, Dr. Nauss has submitted the additional data in which he raises the area



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in that field to 3840 acres?

A Yes.

Q And you disagree with the conclusion he has reached?

A I would be inclined not to go that far, Mr. McDonald. Fringe wells that were tested, like Legion, I believe it was tested, Dome Western - - the only good test, that is water-free gas, came from Imperial No.17 on the high part of the dropover. I have in mind Imperial Metro No.2, Calmont-Excelsior No.1, and the rest of them, and I would hesitate very much to go beyond the 40 acres which are assumed will be the producing area. I would regard that as being prudent about the matter.

Q However, there are a considerable number of wells drilled in that area?

A Yes.

Q The information is available?

A Yes.

Q It is a matter of judgment?

A Oh, definitely, yes.

Q I was interested, too, in regard to this Cretaceous matter in J-42, which is the chart showing the stratigraphic distribution of petroleum produced in the world to January 1st, 1947. That Cretaceous horizon is given a percentage of 16?

A That is correct.

Q And that would indicate, would it not, that on the assumption you have made when you refer to the Triassic that the Cretaceous is possibly the first or second most

G.E.G. Liesemer,
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productive horizon in the known geology?

A That is right.

Q So that unless something radically is wrong with the Cretaceous age in this Province we can look for substantial production from it?

A We have the authority of all the leading geologists that we can expect it but that has been one of the biggest disappointments to date, we have not found it.

Q Can I put it to you this way, that a great deal of the exploration for gas in previous years and the data which you have referred to has not been carried out with direct reference to obtaining gas production?

A That is right.

Q So that in searching for gas in the Lower Cretaceous or in the Cretaceous horizons that if due regard was taken to proper tests and proper setting of pipe and avoidance of water influence, proper producing on initial production, that the Cretaceous will produce a great deal of gas. Would you agree with that?

A I think there are possibilities there, yes, at least, we are hoping for it.

Q In other words, a different technique of handling the gas showings in the Cretaceous might result in a complete reversal of the experience up to date in the Cretaceous?

A Well, yes, and possibly the unexplored regions to the north we might run into continuous bedding.

MR. GOODALL:

Mr. McDonald, are you referring to Cretaceous as the whole interval from the top of the Colorado down or the Lower Cretaceous?

G.E.G. Liesemer,
Cr. Ex. by Mr. McDonald.

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MR. McDONALD: With reference to J-42 it
is the whole Cretaceous, yes.

MR. GOODALL: Bow Island sand, Viking
sand and all?

MR. McDONALD: That is right. In dealing
particularly with my question to Mr. Liesemer with regard
to the completing of those wells I think the Lower
Cretaceous is what I refer to.

Q I think the Viking has had different treatment in this
Province than the Lower Cretaceous?

A That is right.

Q I mean, the Viking is an easily ascertainable horizon?

A It is. You can find it almost anywhere. In the one big
field we have they operate with very little trouble at all.

Q I would not want to include the reference to the Viking
in the discussion we had a moment ago. Does that make it
clear, Mr. Goodall?

MR. GOODALL: Yes.

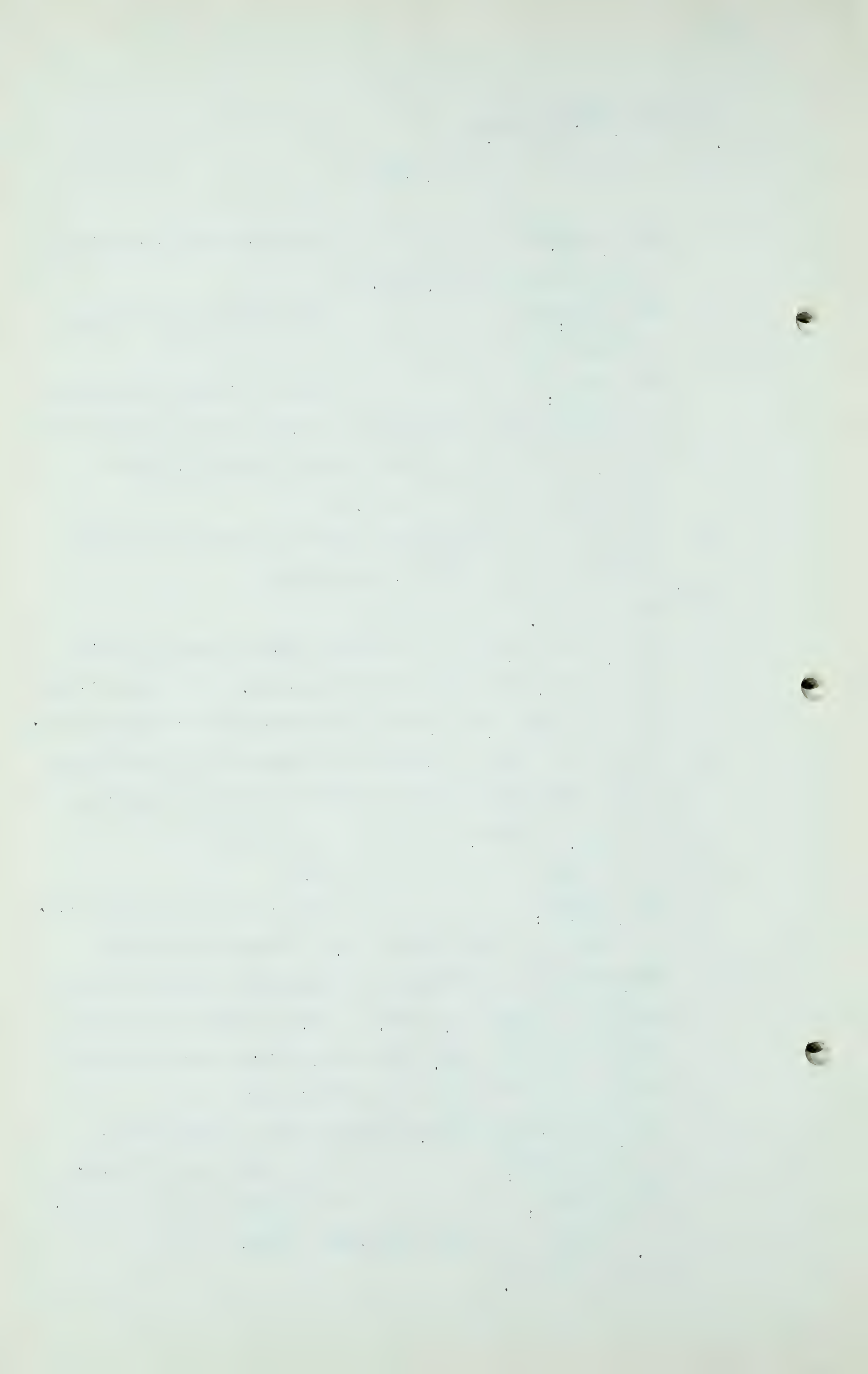
Q MR. McDONALD: Only one thing here in J-42.
The heading of this exhibit is, "A Chart showing the
stratigraphic distribution of petroleum produced in the
world to January 1st, 1947." Now, are you including in
petroleum natural gas, and if so, between what we know
as oil and what we know as natural gas?

A I was thinking of this, there are also hydrocarbons.

MR. C.E. SMITH: Let us not decide Borys.

Q MR. McDONALD: The point I wish to raise,
Mr. Liesemer, is that this chart, J-42, - -

A Deals with oil.



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Cr. Ex. by Mr. McDonald.
Ex. by The Chairman.

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Q Deals with oil?

A That is correct.

Q I think that is all, sir.

EXAMINATION BY THE CHAIRMAN.

Q I would like to discuss this Whitelaw field.

A Yes, sir.

Q Page 8 of Mr. Crockford's submission. He makes reference to this strike and he said the gas zone proved to be about 150 feet thick. I notice some calculations were made in Exhibit J-29 of Dr. Nauss. I wonder if you have a copy of that exhibit?

A I believe somewhere I have. That is J-29?

Q Yes, page 27 it is.

A I have that.

Q I presume, Mr. Liesemer, that this was left out of your report because you figured the reserve was less than 20 billion feet?

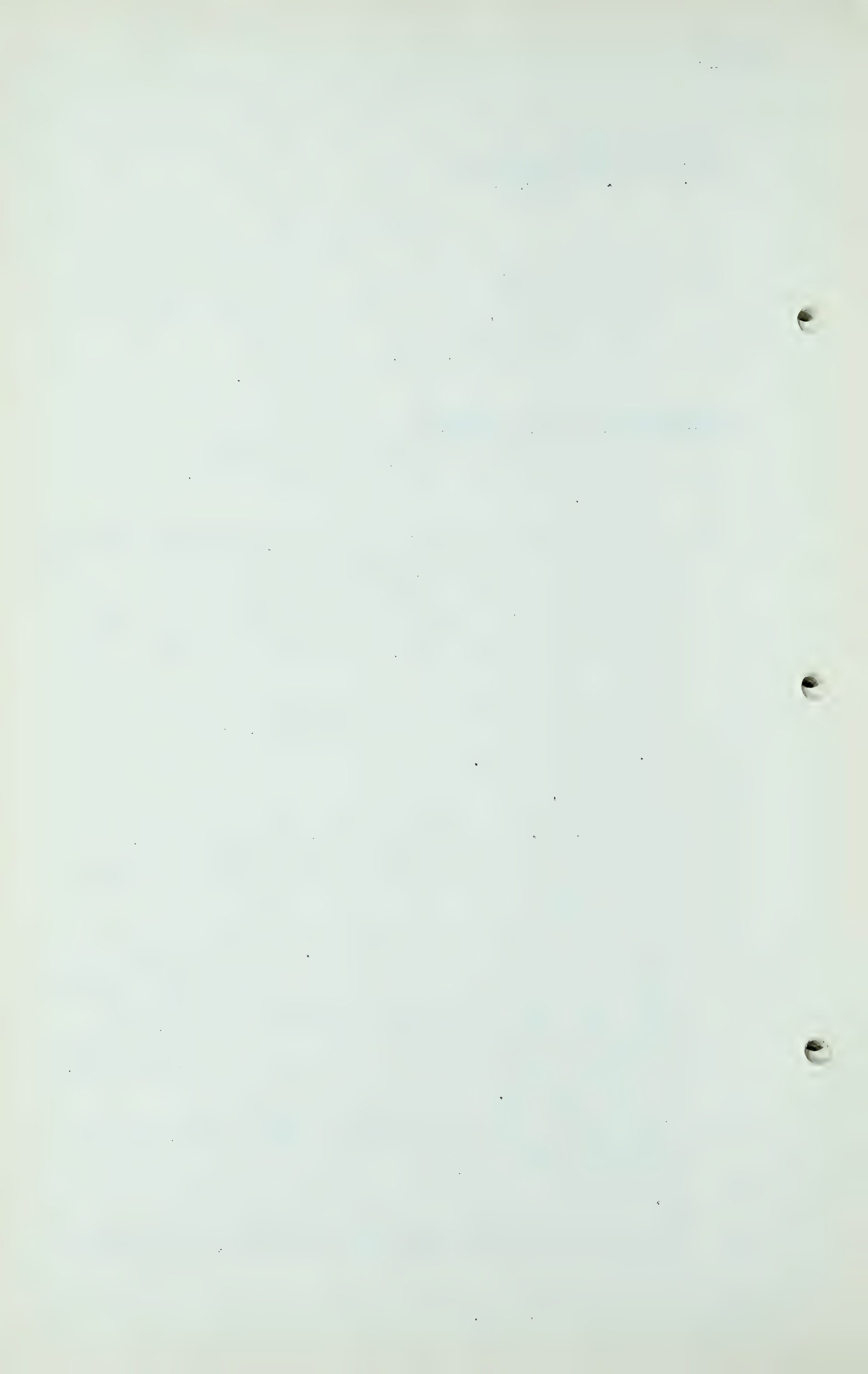
A No, I did not know enough about it. And the other thing there is that I am quite sure at the moment with our knowledge that that comes definitely under the heading of something too far distant. I ignored the Pelican district on the same basis.

Q Isn't there a good possibility it exists there with the thickness of the sand?

A Yes.

Q And the Bluesky well would show the existence of the same sand?

A That is correct, yes.



G.E.G. Liesemer.
Exam. by The Chairman.

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Q But on your own definition of establishing gas reserves under this section.14 in A.G.A., could you not allocate an acreage to that well and figure out the reserves, give it a reserve figure?

A Not on this basis, Mr. McKinnon. It is an entirely new horizon as far as we are concerned, the Triassic.

Q Were there any drill stem tests taken in that well?

A The Bluesky?

Q The Whitelaw and the Bluesky?

A Both wells were very thoroughly tested.

Q Would that not mean an indication of the presence of gas? Could you not make some estimate on that?

A Yes, I could have, but again on the basis of inaccessibility beyond the Peace River I did not bother.

Q I do not quite understand that, Mr. Liesemer. We want to get some information on reserves. Now, did you attempt to enquire from the companies who are doing the development there as to their seismic picture?

A No, I did not.

Q Was there any coring done?

A Yes, we had full core analyses.

Q Did you examine the core analyses?

A We have copies of it, yes.

Q What was the porosity?

A I think it worked out to what Dr. Nauss gave you there. He used 15%, I believe. I go beyond that.

Q Now, would you like to take Dr. Nauss's practice that he has used in his calculation and criticize or tell me if you agree or disagree with him?

G.E.G. Liesemer,
Exam. by Dr. Govier.

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A Everything depends on the number of acres you are going to assume. It is an entirely new formation. I have no idea whether it should be 40 acres or 2,000.

Q With a 150-foot section could you not make some estimate for the purpose of calculating reserves? It is stated right in here that is the method you apply.

A Yes, I could have.

Q You are not prepared to make any reasonable statement or estimate as to the acreage that you think could be allocated for that well for the purpose of calculating reserves?

A If I did, it would be 40 acres.

Q Even though the Bluesky well - -

A Six miles away.

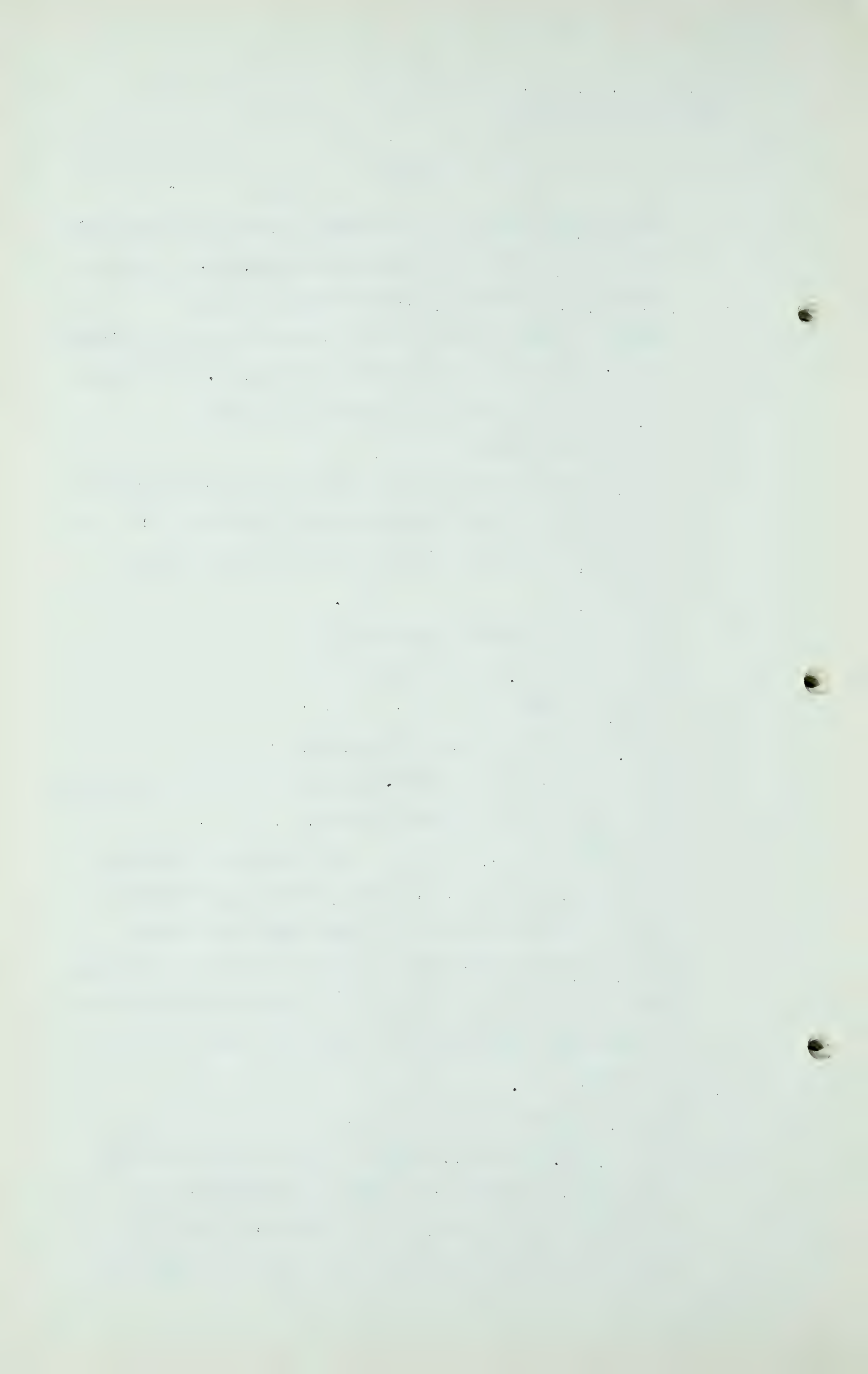
Q - - discovered the same formation?

A Well, it is purely conjecture. We have had no experience whatsoever in the Triassic before.

Q DR. GOVIER: Mr. Liesemer, there are many times a person has to make an estimate based on judgment without particular experience in an area. Do you mean to say that even though the thickness in these two wells is over 100 feet it is your best judgment that the probable areal extent of each well does not exceed 40 acres?

A I do not know.

Q Well, I know you do not know. I do not think anybody knows, Mr. Liesemer, but I can not understand your reluctance to make any sort of estimate. Won't you stick your neck out a little bit? If your figure is



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40 acres we want to know.

MR. C.E. SMITH: Dr. Nauss added about 400 billion in five minutes yesterday morning.

A I should like to see some more wells drilled.

Q THE CHAIRMAN: Oh yes, we would too.

Haven't you tried to find out about the experience in the Triassic in any other part of the continent?

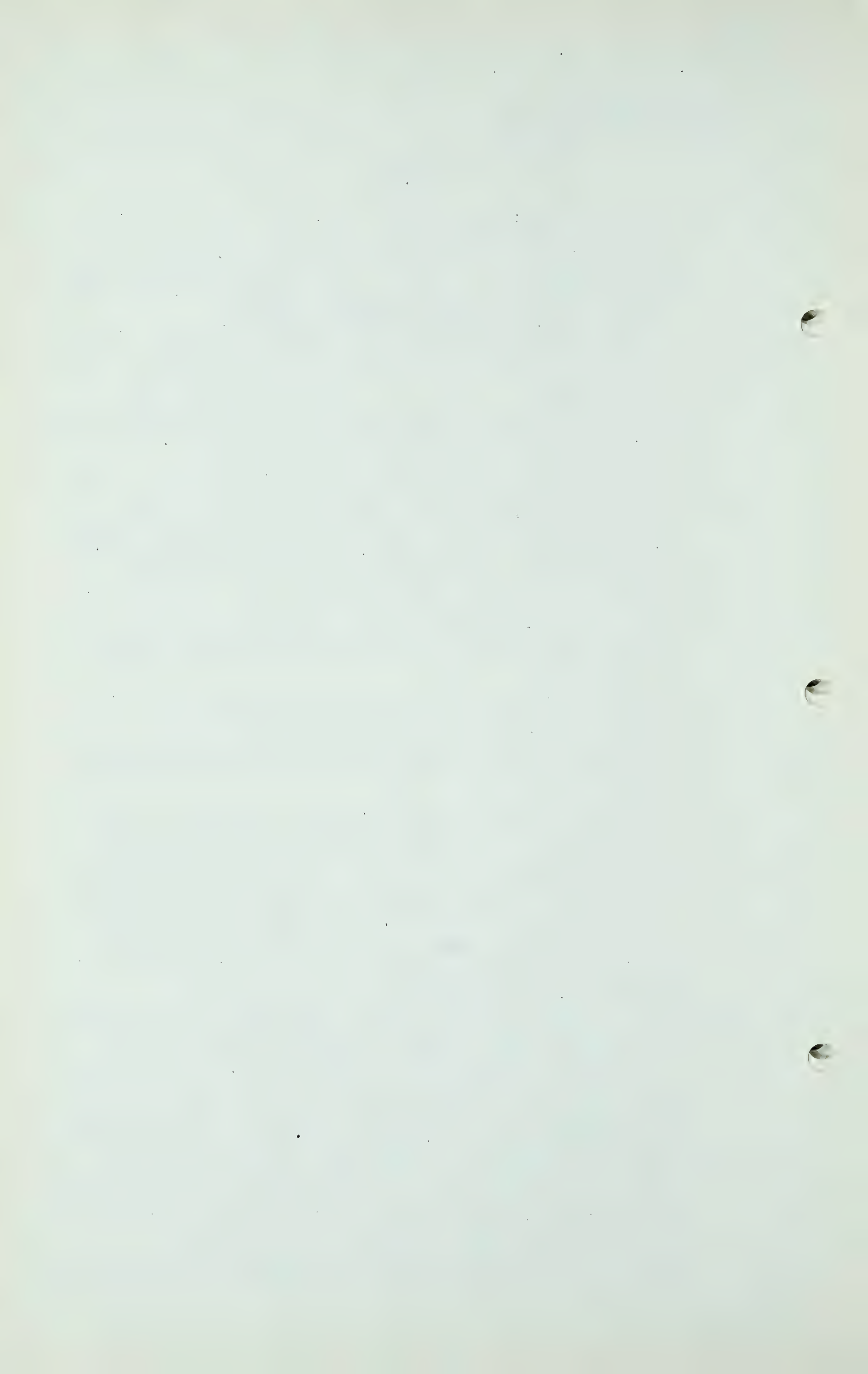
A Yes. We have one field in Wyoming, Chug Water, and it is a very small field. That is why this exhibit happened to be filed. I might discover it was the least prolific of all the horizons. This might be the place on earth where they have a good field in the Triassic, I do not know.

Q Then we have the reverse experience that we have in the Lower Cretaceous. Could you not make a bigger estimate than 40 acres?

A That is not my considered opinion. I have no information on the matter, I do not know. The reason why I ignored it temporarily, these American Gas Association estimates are revised every year as of November 1st. I ignored it because of inaccessibility.

Q Well, I suppose we will have to take that, but I do not understand. Here we have a strike in a new producing zone that has tremendous possibilities for establishing big reserves and you choose to ignore it. I would think following the A.G.A. formula here you would have gone to the companies concerned and found out all the information that you could about a strike of this nature.

A They furnished us with enough information as far as I was



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concerned for the strike itself, but how far does it go?

Q DR. GOVIER: Would you be prepared to make an assumption? Let us assume there is a gas gathering pipe line five miles from the Bluesky well. If that were the case would you be prepared to estimate the amount of gas that might be indicated by these two new strikes?

A I would hesitate very much. We have no previous knowledge of this whatsoever. If I took 40 acres or 2,000 acres it would be purely arbitrary.

Q THE CHAIRMAN: Could you attach any significance to the two wells having this same sand in this Triassic?

A It is a most interesting thing, definitely. To attempt to put a number on it would be purely conjecture at the present moment.

Q DR. GOVIER: What you are doing in effect is you are putting a number on it and your number is zero. Isn't that true?

A No, I did not write the zero down. Simply on the basis of inaccessibility I passed it up.

Q Let us pretend we have a gathering line within five miles, wipe out the inaccessibility, would you still adhere to a number zero?

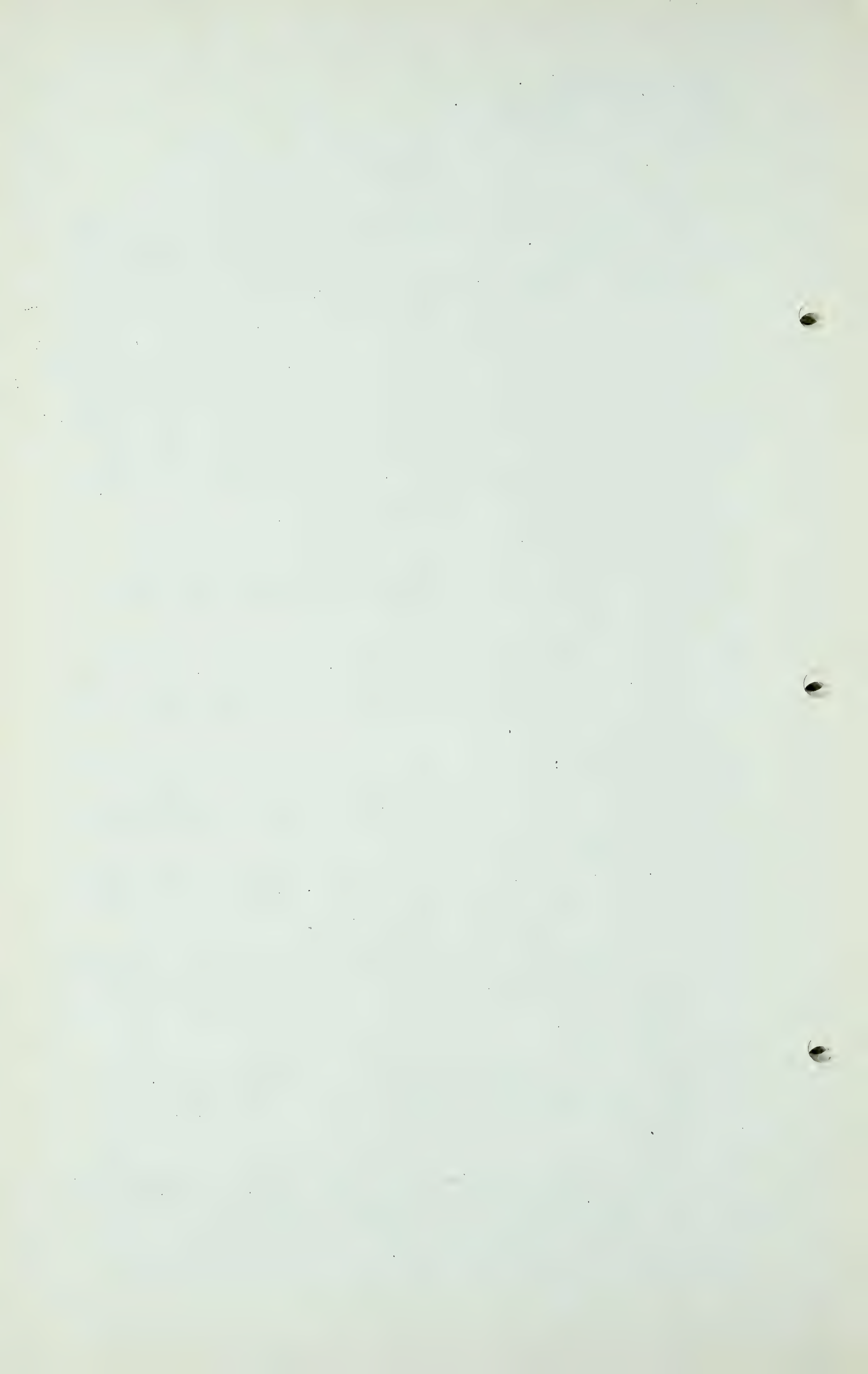
A No. Let us go half way and say a thousand acres.

Q You would assign a thousand acres to each well?

A Yes.

Q Could you make a quick calculation perhaps working from Dr. Nauss's figures to indicate a reserve?

A I think he was conservative.



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Q Take the time to prepare a complete estimate. It will only take two or three minutes, wouldn't it, and we understand that you are making this on the assumption that there is a gathering line right adjacent to the field so this would automatically fit into your category of not within economic reach.

A As I recollect the porosity from the core analysis, it was probably better than 20%, around about 23%.

Q MR. C.E. SMITH: You mean that is about 8% higher than Dr. Nauss gives it?

A Yes. It was a very good sand. I would come out with 137 MMCF's for Whitelaw.

Q DR. GOVIER: That is for Whitelaw or both Whitelaw and Bluesky?

A Just Whitelaw. That is all he gave here in this first estimate.

Q We have the two wells now. What would you do for Bluesky?

A I have a calculation for Bluesky.

Q I do not think Dr. Nauss has, as a matter of fact.

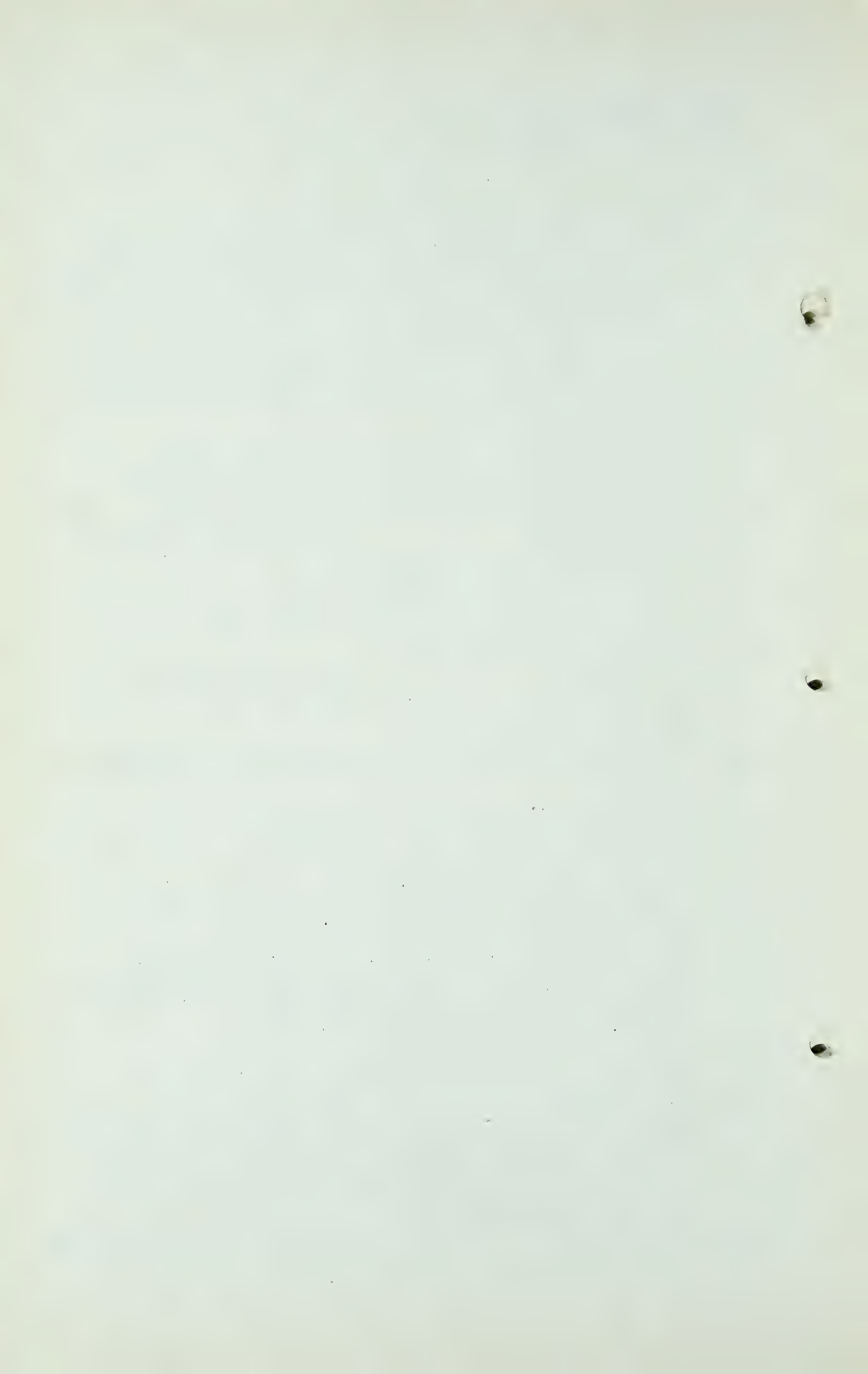
MR. McDONALD: The information, Dr. Govier, is on page E of the report and he uses the same factors as to porosity and connate water.

A 2,000 acres likewise?

MR. McDONALD: Yes.

A What did he get, 70? Yes, he got 70 billion. About 54 billion, and that is using half the area and altering the porosity to 23%.

Q DR. GOVIER: So you have 137 for Whitelaw?



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A Yes, and 54 for Bluesky.

Q Well, let us just add them together. You would not assign anything to intervening acreage?

A Not in view of our knowledge of that particular location.

Q MR. McDONALD: You take 1,000 acres for each well?

A Yes, and 23% porosity. I remember the core analyses. It was really an exceptionally fine looking sand.

Q DR. GOVIER: That is 191 billion cubic feet of gas in place?

A Yes.

Q What would you multiply that by to get the marketable gas?

A In high pressure sand like that it might be 80%.

Q That would be about 156, 158 or so billion cubic feet of marketable gas which would come in your category No. 2?

A Yes.

Q Beyond economic reach of a market?

A Yes.

Q And you want to stress with the Board that you are reluctant to make an estimate with so little data?

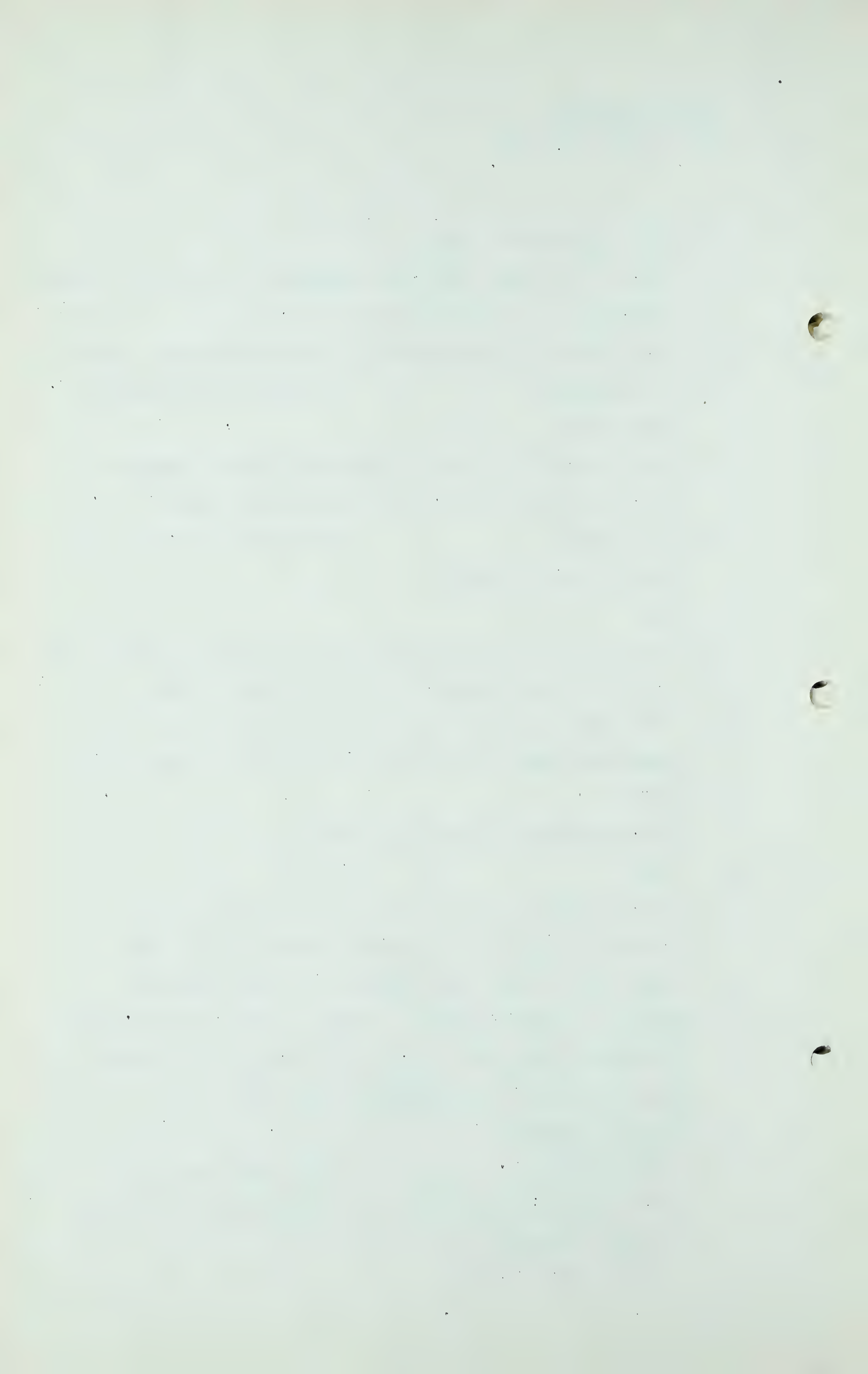
A And in an entirely new formation in this Province.

Q But you do agree with me, I take it, Mr. Liesemer, that if you put down zero you are still making an estimate and it may be even more arbitrary than 1,000 acres?

A That is correct.

Q THE CHAIRMAN: Did I understand you correctly to say that you had not an opportunity of seeing the seismic picture?

A I never asked for it.



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Q Wouldn't that be a reasonable thing to ask for going after a thing like this? Taking the estimate prepared as a whole and going in accordance with this formula of the American Gas Association, would you consider using the seismic picture?

A Oh, yes. I think you would be justified in doing it. You might be deceived sometimes by a seismic picture. I believe it is reasonable, yes, to use a seismic picture.

Q I think that is all.

Q MR. C.E. SMITH: Just one question, Mr. Liesemer. Look at J-29 there, you will see just after page 29 something called Whitelaw Gas Field?

A Yes.

Q And I take it Dr. Nauss purports to represent his opinion and his acreage involved on which he calls this field?

A Yes.

Q Do you know whether or not he got them from any seismic data or anything?

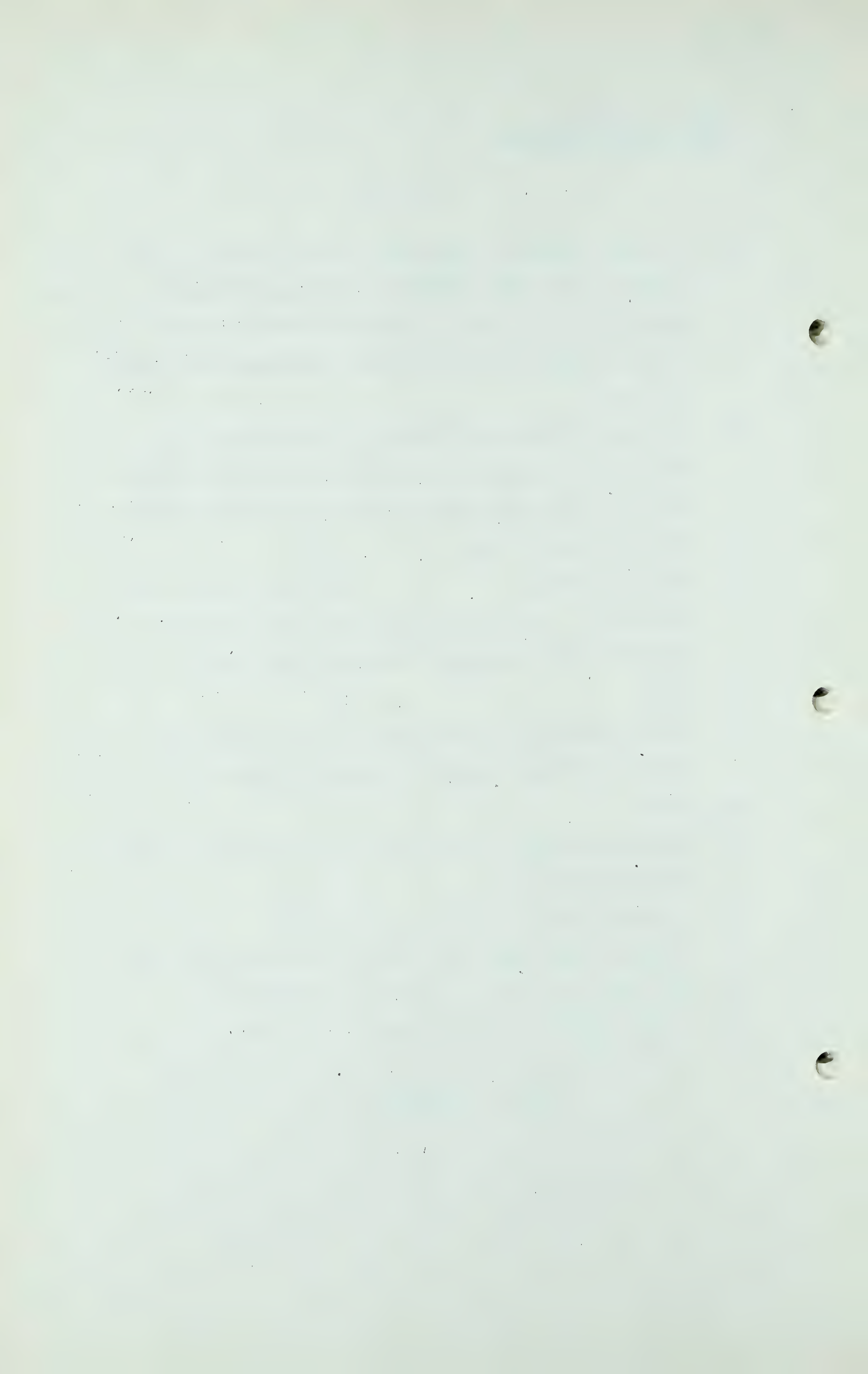
A I do not know.

Q Or did he just draw two circles and then a big one?

A It looks more or less geometric at that.

Q It does awfully. That is all.

(Go to page 968)



M. B. B. Crockford,
Dir. Ex. by Mr. C. E. Smith

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MICHAEL B. B. CROCKFORD, having
been first duly sworn, examined by Mr. C.E. Smith, testi-
fied as follows:-

Q Mr. Crockford, by the way, what is your official title?

I am not too sure myself. Provincial Geologist, is it?

A Chief Geologist of the Petroleum & Natural Gas Conser-
vation Board, and also Provincial Geologist, Department
of Mines.

Q You serve a dual capacity?

A Yes.

Q I think I need not go through his educational background
and experience, sirs.

THE CHAIRMAN: No.

Q MR. C. E. SMITH: Mr. Crockford, you have pre-
pared a submission for presentation to the Board, which
you have in front of you?

A Yes.

MR. C. E. SMITH: May I tender that, sir?

THE CHAIRMAN: Exhibit J-48. I am sorry,
it is Exhibit J-49.

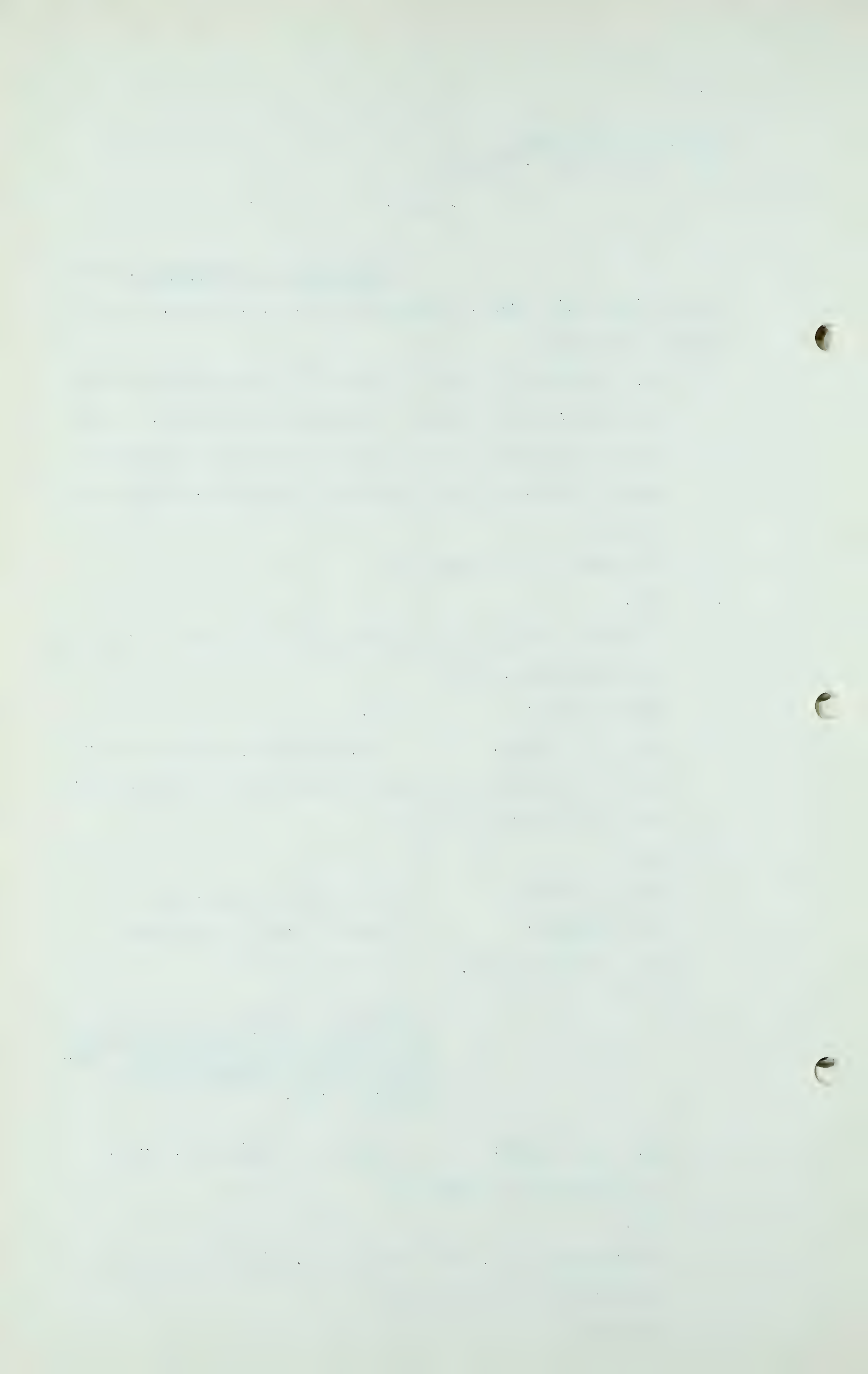
SUBMISSION ENTITLED "A SUMMARY OF
THE GEOLOGY OF ALBERTA IN RESPECT
TO NATURAL GAS OCCURRENCES"; PRE-
PARED BY MR. CROCKFORD MARKED
EXHIBIT J-49.

Q MR. C. E. SMITH: And this submission, J-49,
was prepared by yourself?

A Yes.

Q Independently of, as I said to Mr. Liesemer, of me or
the Board or anybody else?

A Entirely.



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M. B. B. Crockford,
Dir. E. by Mr. C.E. Smith
Cr. Ex. by Mr. McDonald

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Q It is your own submission, in other words?

A Yes.

Q As you have observed while you have been sitting here, we have not been reading submissions, except to indicate anything that you want to refer in your written submission by way of oral explanation, or expansion, and then I will leave you to the gentlemen here and to the Board. Is there anything else you want to mention, Mr. Crockford, or would you wait until they ask you questions?

A I would just as soon wait until they ask me. I think they have had it in their hands for some time.

Q Two weeks?

A And probably have read it. I do not think it should be necessary to go through it.

.....

CROSS-EXAMINATION BY MR. McDONALD:

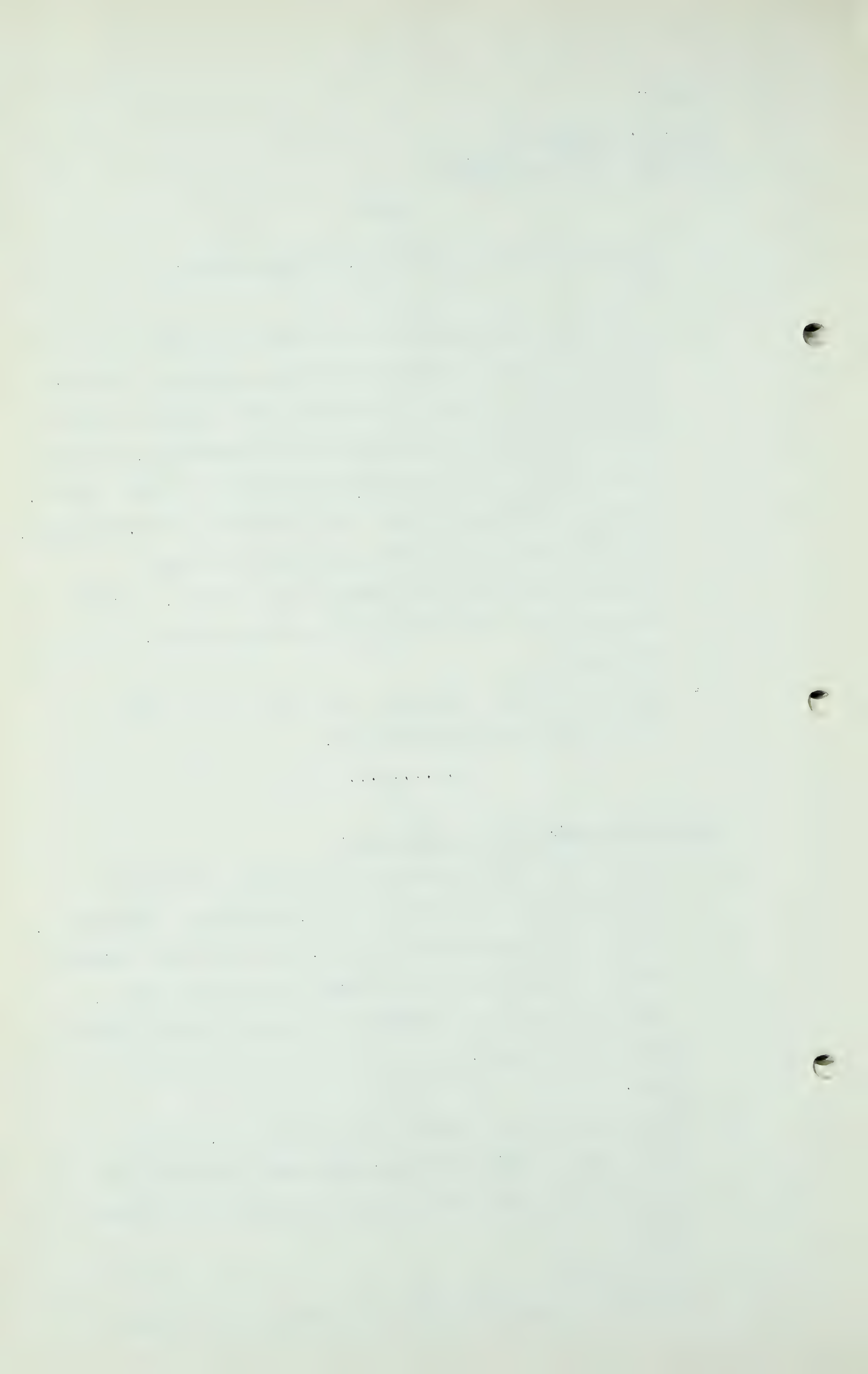
Q Sir, I would like to draw the attention of the Board to the reference on Page 8 of Mr. Crockford's submission, J-49. The last paragraph, sir, deals with the Triassic strike at Whitelaw, and you make the statement here, "The sand appears to be marine and should extend over a considerable area."

A Yes.

Q That is the general conclusion, I take it, that you made with the limited information which was available to you at the time this report was prepared on October 31st?

A Yes.

Q And the Bluesky well has been completed, isn't that



M. B. B. Crockford,
Cr. Ex. by Mr. McDonald
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correct?

A Yes.

Q And, for instance, the electrolog was only released on Monday of this week?

A We haven't an electrolog on the Bluesky well. I have no information on the Bluesky well except the drillstem tests, and they are not quite complete.

Q Yes?

A But they do show gas at the same horizon as the large flows in the Whitelaw well?

Q And you have no reason to modify that statement that I read to you in your report at this time?

A None, except perhaps, it is my information that the Bluesky well has not produced gas in as large quantities as the Whitelaw well, and it looks as though the sand may be pinching out in that direction.

Q Yes?

A That is to the southeast.

Q That was indicated in the statements made by Dr. Nauss yesterday?

A I do not recollect whether the statement was made or not.

Q Yes, all right.

MR. MARTLAND:

I have no questions, sir.

THE CHAIRMAN:

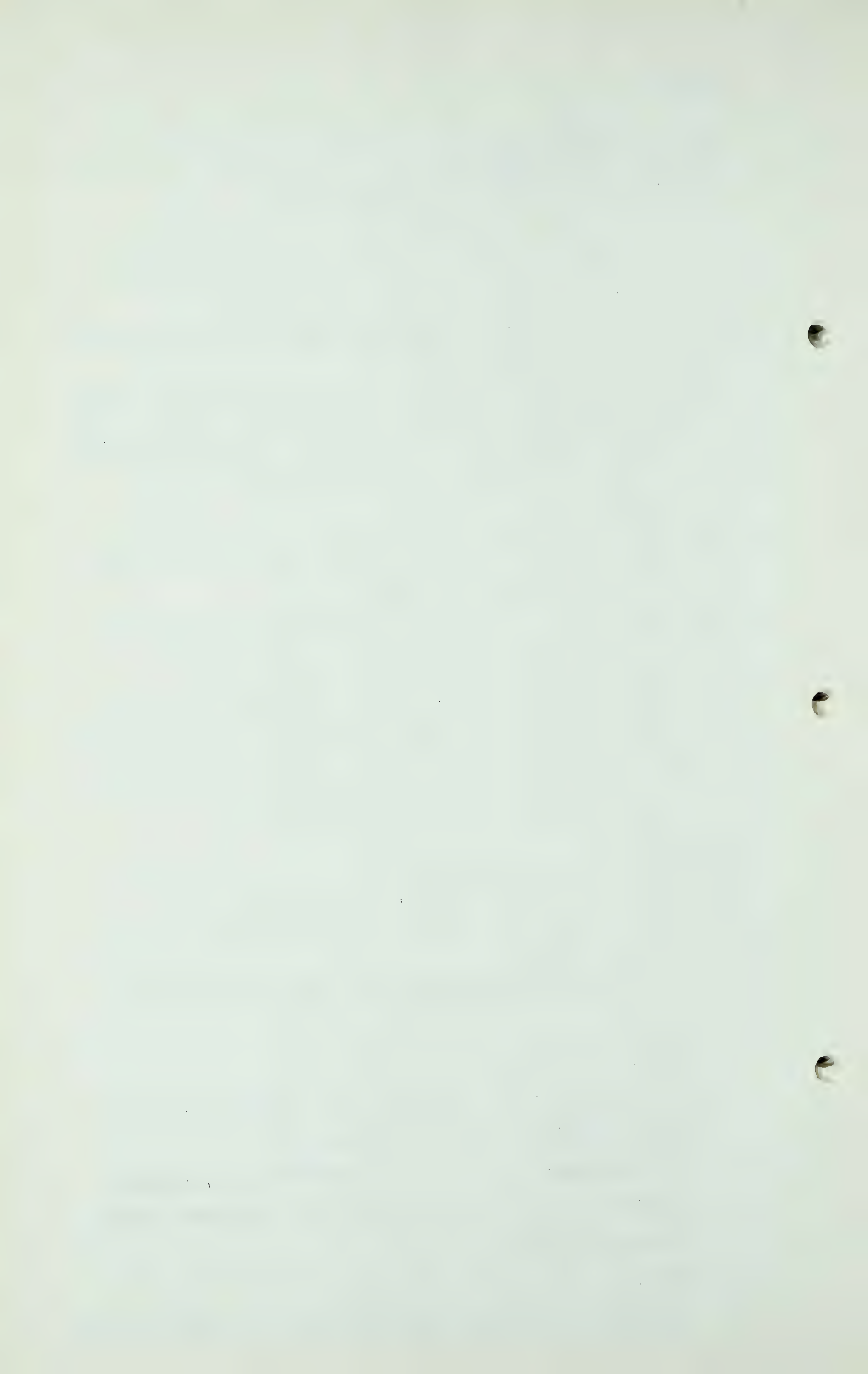
Anybody else?

Q MR. GOODALL:

Mr. Crockford, Mr. Liesemer mentioned that you had considerable experience in the Princess field?

A Yes.

Q Could you give us some information on the sands, the pro-



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ducing sands in that area?

A I think that can be answered very well by reference to Figure 7. Do you want any particular sand, Mr. Goodall, or just a general summary of the possible horizons, the gas-producing horizons at Princess?

Q Yes.

A Figure 7, a cross-section of the Princess field, is shown, or the cross-section close to the Princess field.

Q Yes?

A Now, in the Princess field there are a number of possible prospective gas-producing horizons. You might just refer to the diagram, starting at the top, the uppermost one is the Milk River sand.

Q Yes?

A That produces gas at Brooks, but as far as I know has not been tested in the Princess field.

Q Yes?

A Number 2 is not present in the Princess field. That is the Medicine Hat gas sand.

Q Yes?

A Number 3, the Bow Island sands are fairly well developed there, not as well developed as to the south, that is, further up the flanks of the Sweet Grass arch.

Q Yes?

A This sand has produced some gas in the Princess wells, The Princess-Steveville No. 1, I believe it was, or Princess-Steveville No. 2, produced some gas.

Q Yes?

A A small quantity of it, and also has produced small quantities of oil. It does not look to be a very

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promising horizon. I might say that this sand has not, I am sorry, this sand has been tested in very few wells, not more than five or six wells.

Q Yes?

A Number 4, the Basal Colorado sand, that sand extends over a considerable area, it is a green sand and occurs at the very base of the Colorado. This sand has been tested in very few wells, unfortunately. In some wells it has produced flows as high as 10 million cubic feet per day.

Q Yes?

A As this sand extends northwards, having regard to recent wells drilled by Canadian Delhi Corporation, they have produced or contained considerable flows of gas from this same horizon.

Q Yes?

A It looks to be quite a promising gas zone.

Q Yes?

A Number 5 is the Basal Lower Cretaceous sand, locally called the Sunburst.

Q Yes?

A This sand has rather an erratic distribution in the Princess area. It was deposited apparently between the limestone knobs or hills. Reference to the diagram shows it is separated from the Mississippian limestone and had an erosional nonconformity. During the interval when the limestone was exposed, it was eroded into hills, and apparently the sand was deposited in the hills, that is, in the valleys between them, consequently, you cannot always tell whether it is present or not until the



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location is drilled. On some occasions the sand is entirely missing, and in some other wells the sand is very shallow and unproductive, but wherever the sand is well developed it has an excellent reservoir. It is a coarse sand, and it has yielded large quantities of gas in quite a number of wells.

Q Yes?

A Number 6 is not present in the Princess area, that is the Ellis sand. It is present in Medicine Hat and westwards of Medicine Hat, but has wedged out before the Princess area was reached.

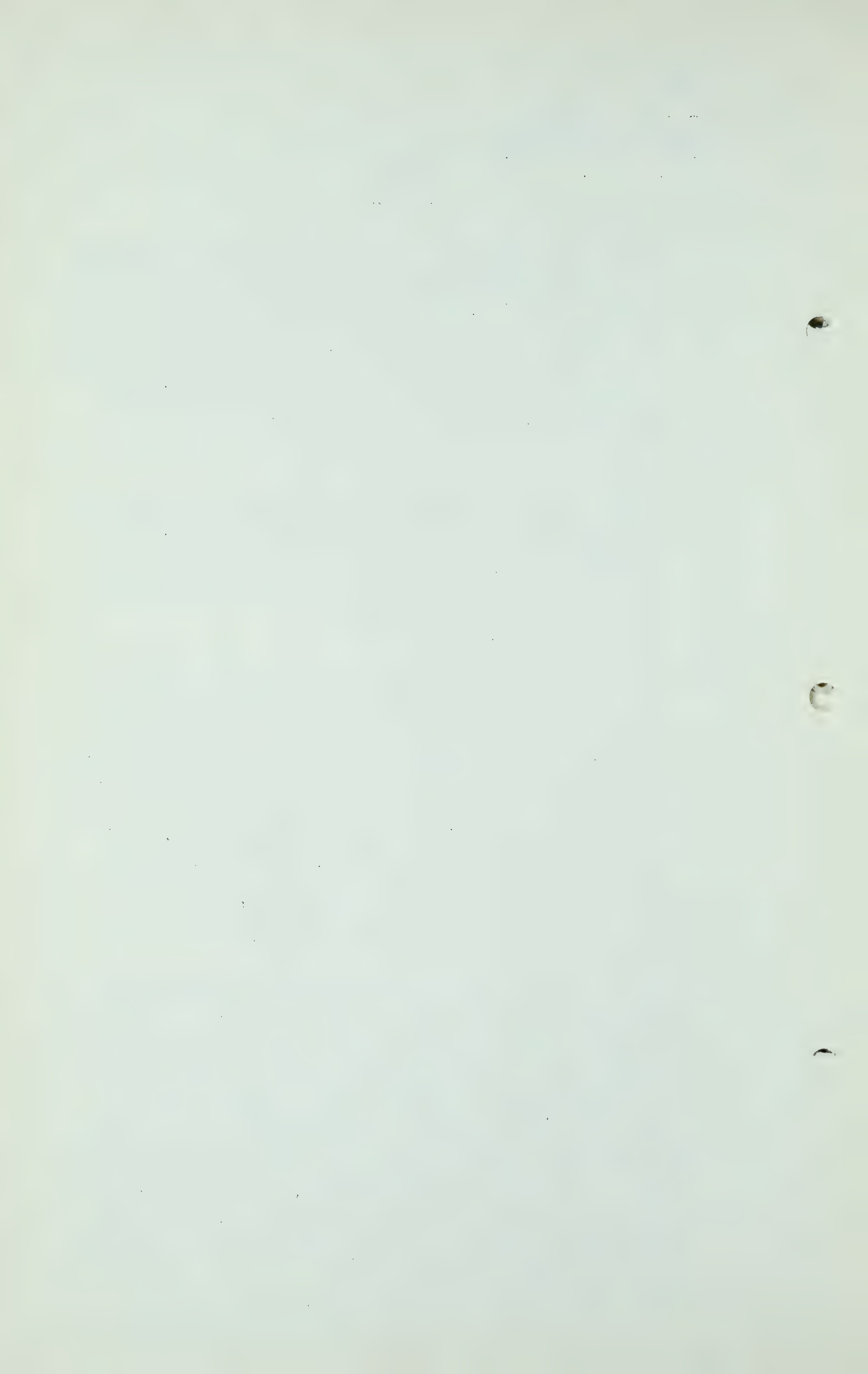
Q Yes?

A Number 7 is the Detrital zone. It underlies the Sunburst, and it consists of green shale and some sand. It also has some porosity in the sand and is deposited between the knolls, and it has produced some oil, some oil and some gas in some wells, and although it has been tested it cannot, I do not think, be considered as an objective horizon for drilling.

Q Yes?

A Number 8 is the Mississippian limestone, and they are accumulations of gas and oil that have taken place at the top of the limestone hills in places wherever the weathering of the limestone member exposure produced porosity. This porosity is not developed in all of the erosional members or remnants, but is a gas-producing zone. It should be considered along with one of the other zones, but it is not in itself, I do not consider it an objective horizon for gas.

Q Well, would you consider the Sunburst, the Detrital



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and the top of the Rundle, or the Madison limestone, as a unit in considering a reservoir for gas, that they are connected in any way?

A I do not quite get your point.

Q Well, would there be one reservoir in place? Is it possible that the sands of the Detrital zone or the Sunburst zone might be lying against the Madison high or hill, as you describe it, and be connected up, and that the porosity would extend from one formation to the other?

A That is true to a certain extent in the Princess field. There has been folding after the Sunburst sand was deposited on the north bend of the Princess field, and the Sunburst sand and the Detrital and the Madison limestone are all present there, and, apparently, they could be all productive.

Q Yes?

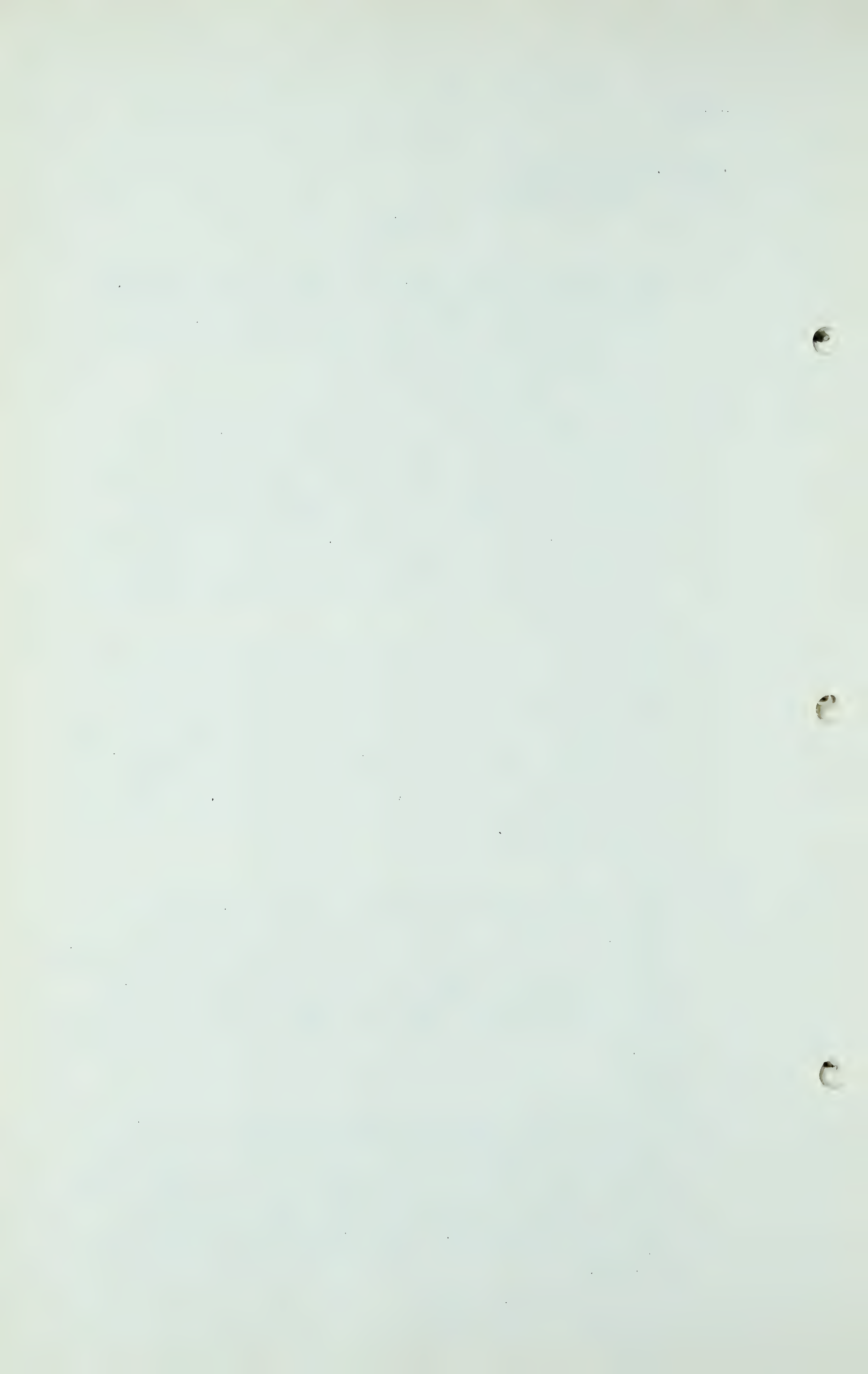
A When the sand was deposited it, apparently, filled the valleys, partly filled the valleys between the limestone, and following the deposits there there is a folding, there is a definite trend of folding through the Princess field.

Q Yes?

A And some of the Sunburst sand was caught in the fold or formed the crest of the fold, and so in some places you will find that you have these three producing horizons, the Sunburst, the Detrital and the Madison limestone.

Q As separate reservoirs?

A Pardon?



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Q As separate reservoirs?

A Possibly the Sunburst sand is a sort of a blanket of sand, apparently lenticular and separated by shale, and so it made up a separate horizon, although it appears to me that the source of the oil and gas in the Sunburst was the Rundle or the Mississippian limestone.

Q In the area, would you agree with the acreage of the Sunburst gas horizon that was submitted by Mr. Galloway yesterday?

A No, I do not. I think that his southern extension of the Sunburst sands, they could be there, but I do not think there is enough evidence on which to base a reserve figure.

Q And then we have also heard, I believe, that the Jefferson is a producing or possible producing horizon.

A Yes.

Q Can you tell us anything about that?

A Which one?

Q The Jefferson?

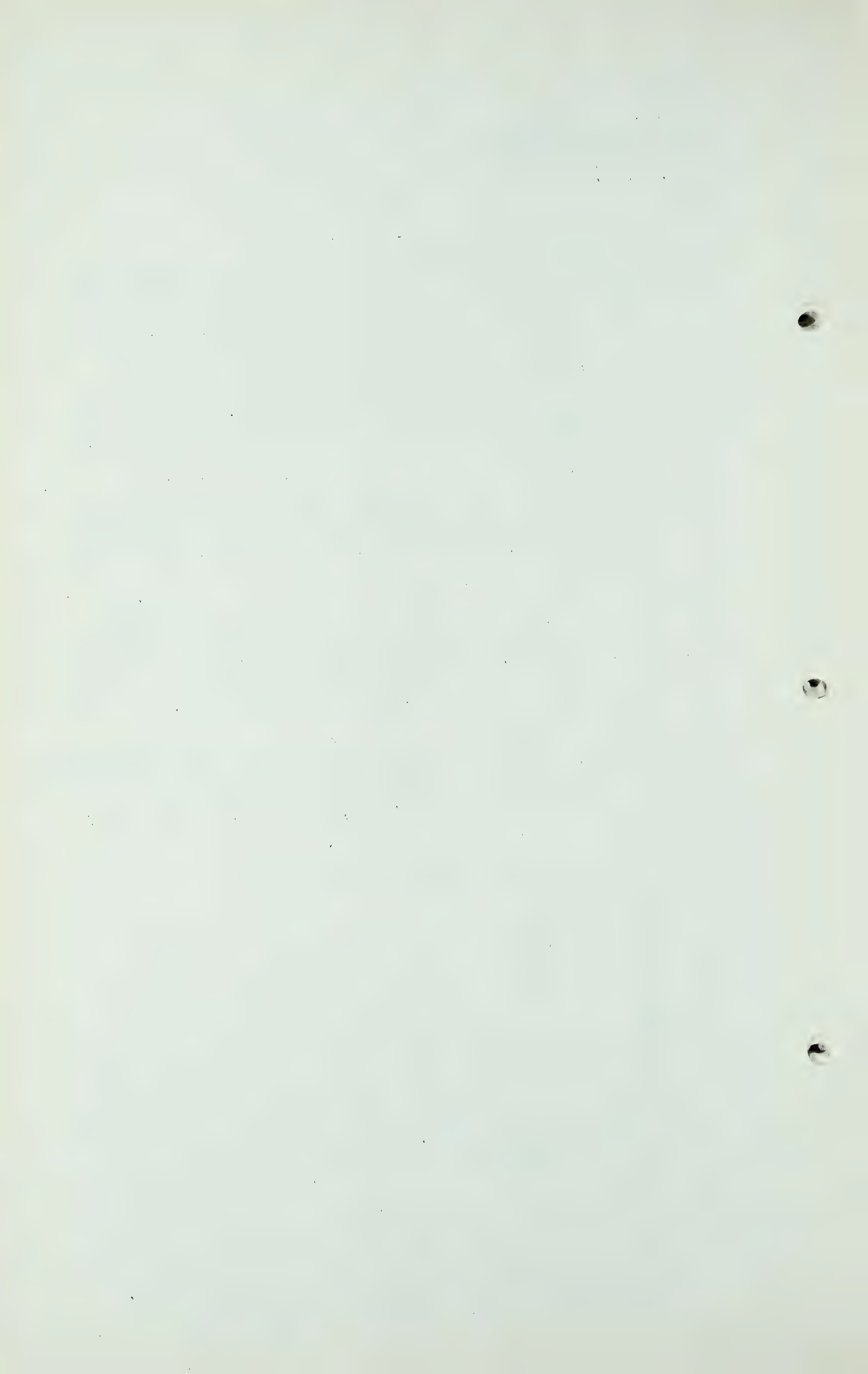
A The Jefferson?

Q Yes?

A The Jefferson approximately correlates with the D-3 horizon farther north. The porosity occurs in the Jefferson in the upper 125 feet. That is immediately below the Three Forks shale and potlach anhydrate.

Q Yes?

A There are two porous zones in the Princess field. The porous zone, the upper porous zone contains gas, and the second lower portion is oil-bearing, and



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the oil in the Princess field is obtained from this lower porous zone. Estimates for gas reserves are based almost entirely on the gas in the upper porous zone.

Q Yes?

A In one part of the field the second porous zone is high enough structurally to be gas-bearing, but the area is relatively small, only perhaps 50 acres.

Q Then you would not consider any large reserves for the Jefferson?

A No.

Q Yes?

A It would not affect the total reserve figure probably any more than three or four or five per cent?

Q We have had quite a lot of discussion on the Morinville field?

A Yes.

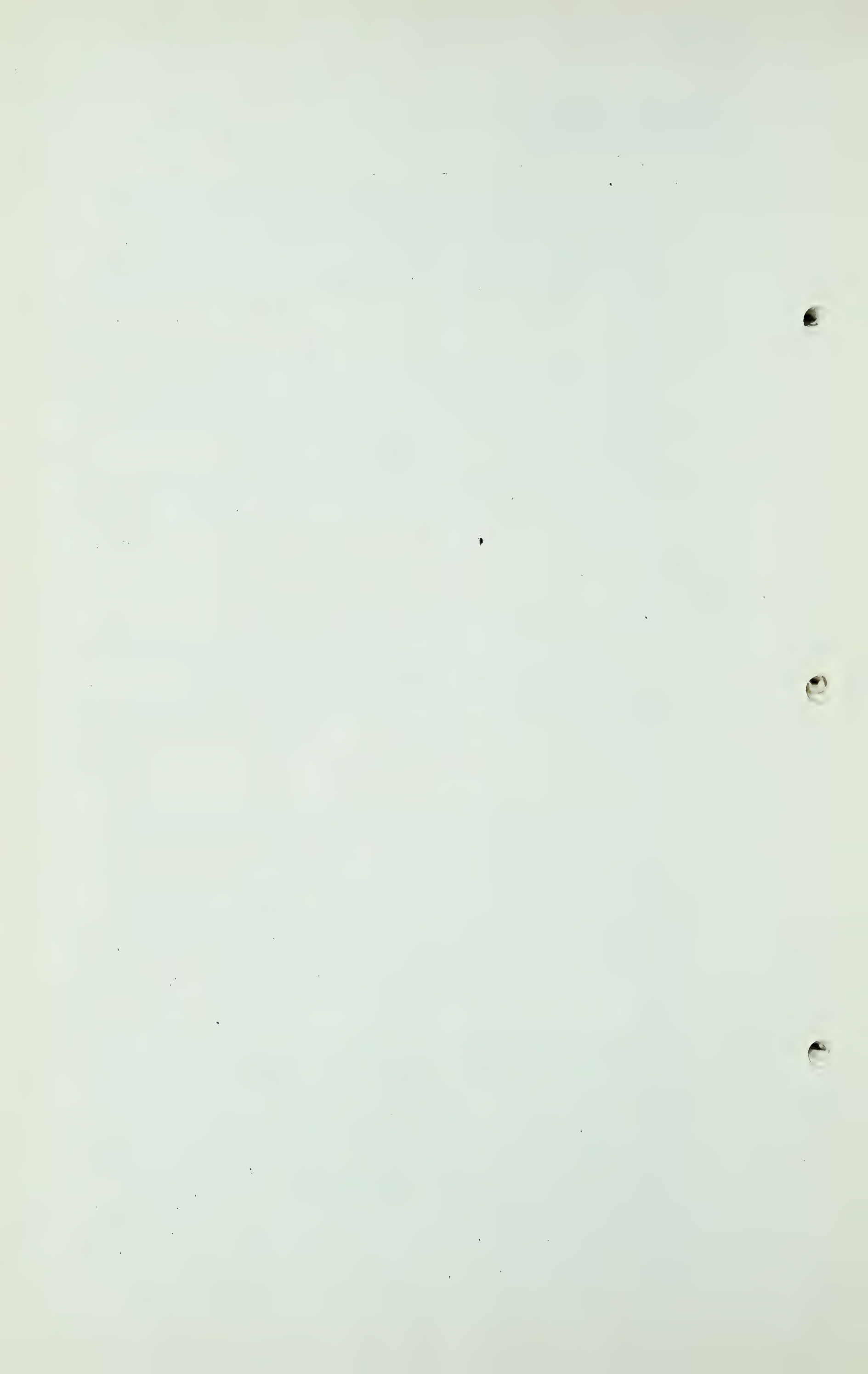
Q And I was wanting to get your opinion of the possibility of gas in that area?

A There is no doubt that there is a lot of gas there. For my part I hesitate or would hesitate to put in or go into the reserve figures on that field.

Q Yes?

A The Quartz sand itself is very low in thickness, and, moreover, the wells on which some reserves have been based are too far apart, in my opinion, to consider or separate any calculations. The reliability of the Quartz sand, the Basal Quartz sand is taken into account in Figure 10.

Q Yes?



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A I might say that in the Morinville field there is very little information on which to come to any real hard and fast opinion as to the variations in the sand.

Q Yes?

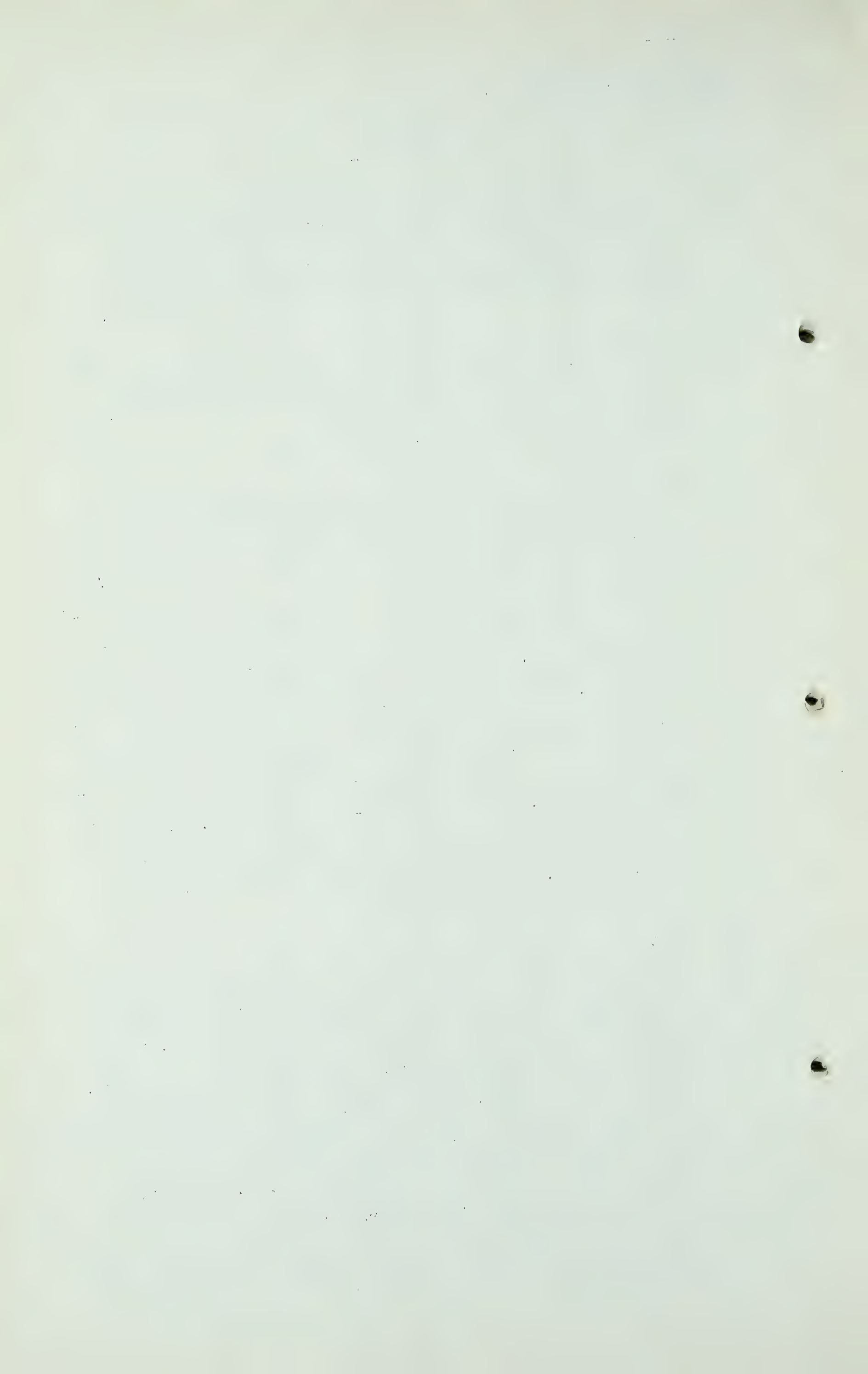
A However, the Excelsior field is pretty well or is being drilled up quite rapidly and supplies us information which may be used for comparison.

Q Yes?

A The Index Map Number 2 shows the position of the Excelsior field with regard to the Morinville wells. Imperial-Morinville Number 1 is just north and slightly west of the Excelsior field. Morinville, Imperial-Morinville No. 2 is due west, the Cardiff Giant is southwest, about four miles, the Pacific Calahoo is, oh, about ten or twelve miles west. To join up those four wells, Pacific Calahoo, Cardiff Giant, Imperial-Morinville No. 2 and Imperial-Morinville No. 1, you will see that they are separated by distances from three to twelve miles, and a lot can happen in those distances in the way of variation of sand.

Q Yes?

A The Figure 10 was drawn up just to show what can happen in the space of a mile and a quarter in the Excelsior field. In the Figure there, there are six electrologs, which show the Basal Quartz sand. These electrologs are taken in an east and west direction across the Excelsior field as shown in the Index Map No. 1. They are all Imperial wells. the electrologs are related to the ostracod marker, and its shale zone is quite persistent and forms an excellent key on which to draw



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a diagram.

Q Yes?

A The top of the Basal Quartz sand is shown in the Figure and you will notice that it is regularly about 20 feet or so below the ostracod marker.

Q Yes?

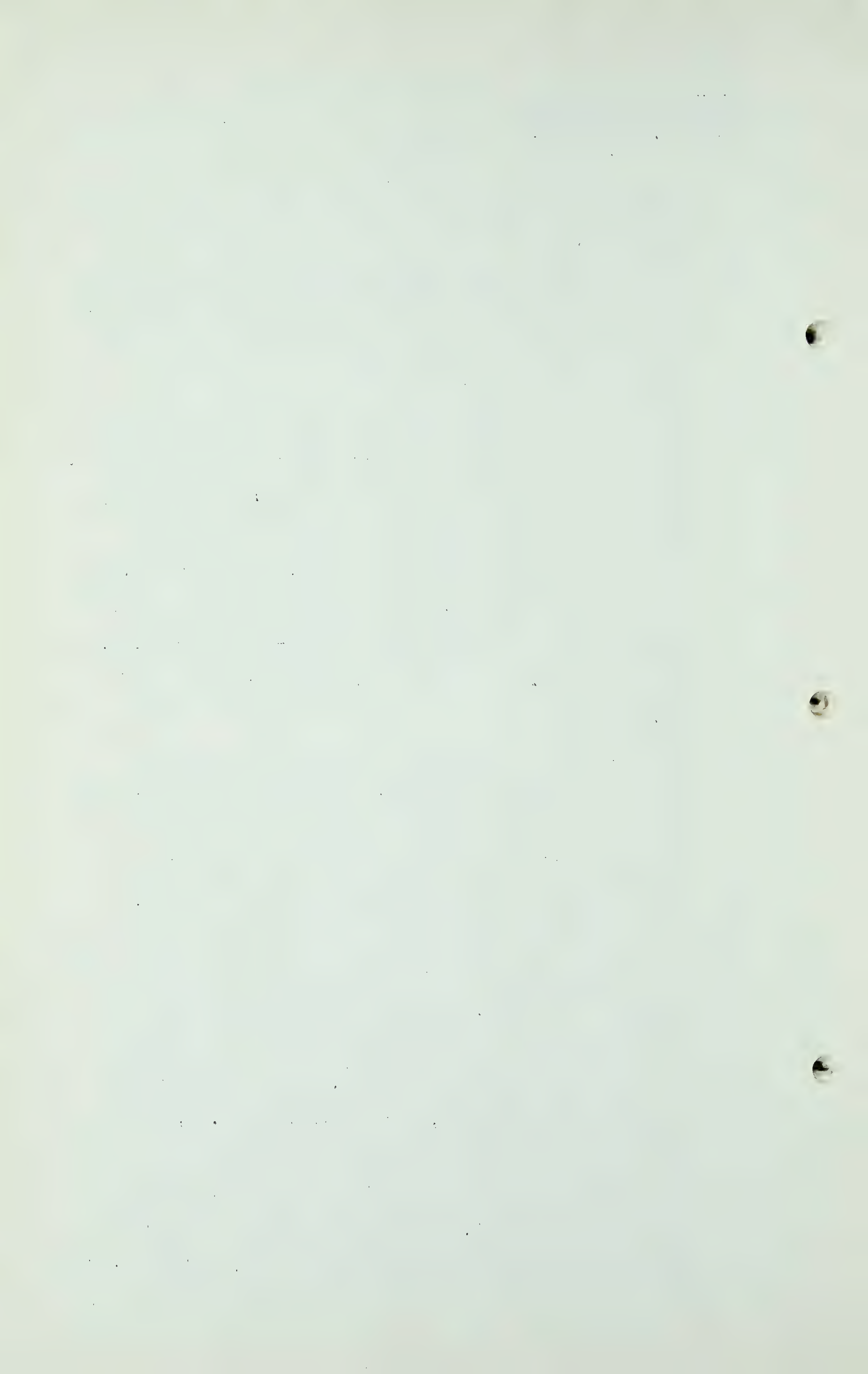
A The porous permeable zones are indicated in the Figure, and you will notice that they vary in some of them, the distance from the top of these zones to the top of the Basal Quartz member is variable. In Number 8, Imperial-Excelsior No. 8, it has about 20 feet average Quartz sand. In Number 2, Imperial-Excelsior No. 2, about 45 feet. In Excelsior, Imperial-Excelsior No. 15, about 10 feet, and in the other two wells about 8 feet.

Q You heard the discussion Mr. McDonald had with Mr. Liesemer regarding the shale break between the water and the gas section. Have you any comment on that?

A I believe that was in relation to a specific well.

Q Does that show up here on these Excelsior wells?

A The shale breaks which are indicated in the Figures are not at all uniform. It changes in and out quite rapidly. I should mention here that these wells are one-quarter of a mile apart, so that in a quarter of a mile you will have, for example, in No. 8, that sand section starting about 20 feet below the top of the Quartz member and extending down to No. 5 to about 30 or 40 feet, as indicated by the electrolog, and it apparently has moved down section. What has actually happened there is that it has petered out



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in part, I believe, in No. 2. The upper sandstone is replaced by shale in No. 2 well, and some of the shale in No. 8 has developed into sand in No. 2. No. 17 shows the best sand section of the group. You have there quite a thick sand. It begins to shale out eastwards, and in No. 10 the sands are not as permeable. In No. 5 you will notice that there are inter-beds of sand, sandy shale and shale in the same section.

Q I take it that you would not consider the one shale bed to be continuous over the area?

A I think you must refer to the shale just above the Basal Quartz sand.

Q No, I mean when it goes down into the quartz member it separates the oil from the gas, or oil and gas from water?

A There are some wells, but, in my opinion, that would be more or less accidentally there, with the shale break between the oil and the gas.

MR. C. E. SMITH: We are still getting oil here?
Water in the gas, you mean, between the water and the gas, isn't that what you mean?

A Yes, between the water and the gas.

MR. GOODALL: We have oil in one of these.

MR. C. E. SMITH: My apologies.

A The water line has been checked in these wells, and in No. 17, Imperial Excelsior No. 17, the water line can be established by the drill stem tests. I have shown at the side here a summary of the drill stem tests which indicate the gas/oil interface, the gas/oil interface

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and the oil/water interface.

Q Yes?

A I can just run over those, and if you will take drill stem test No. 2 in the interval indicated, it produced gas at 6 million 284 thousand cubic feet per day. Drill Stem Test No. 2 also shows gas, and that is shown up here. No. 3 also showed gas. It also shows quite clearly there the effect of the shaling out of the sand. In this interval gas was produced at 2 million and 70 thousand cubic feet per day - you can see that on the electrolog, the curves are drawn in there.

Q Yes?

A No. 3 also produced gas, 6 million 500 thousand cubic feet per day. No. 8, and it is No. 8 that is significant, in that the gas was produced along with a spray of oil, thereby indicating the gas/oil interface.

Q Yes?

A And Test No. 11 indicates the oil/water interface here. The valve was open one hour and recovered 195 feet of salt water. You will notice there is no significant break of sand or shale break at the gas/oil interface.

Q Yes?

A Apparently the water interface, there is a shaling-out there, however, and looking at No. 15, the water line there is picked on the electrolog; that would be the oil/water line, and that occurs in the middle of the sand member without any noticeable shale break. There are no drillstem tests in this horizon for No. 15, so that that water line was picked on the basis of the

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electrolog.

Q Thank you, Mr. Crockford, I think that is all I have.

THE CHAIRMAN: Thanks, Mr. Crockford.

MR. NOLAN: Mr. Chairman, before the adjournment there is one matter that I would like to bring up, if I may, please.

THE CHAIRMAN: Yes.

MR. NOLAN:

From time to time there have been discussions about the gas contracts which have been entered into by the Northwest Company with Standard of California, the Shell Oil Company and the Imperial Oil Limited, and the Board will remember that when we filed our application, at the request and direction of the Board we filed a number of copies of those contracts with the Board and they are in the Board office now, but they have never been marked as exhibits in these proceedings, although they did accompany the application and were filed with it, and I thought that, perhaps, for the purpose of making the record quite clear, the Board would give numbers to those contracts, which I would tender as exhibits this morning.

I also would like to remind the Board that they have had a considerable amount of evidence with regard to the Imperial contract, and the fact that the Imperial has disposed of its holdings in the Kinsella field.

Also with respect to the Shell contract there is a discussion with regard to it by

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Mr. Dixon on pages 485 to 487 of the transcript, Volume 6, on the Joint Hearing, and in the course of his remarks at that page beginning 485, Mr. Dixon had this to say about the Shell contract. He was reading from Section 4.(a) of the contract:

"Seller now has three gas wells in the Jumping Pound field. Upon notification from Buyer that it has received delivery from the mills of at least 15,000 tons of steel for construction of Buyer's pipe line system, Seller shall with reasonable diligence commence and drill an additional well in said field, and following completion of said well, whether as a producer or a dry hole, shall commence and drill another well; provided, however, if Seller so elects Seller may drill either one or both of such wells prior to the time when Buyer is privileged to give such notification. If necessary for performance of its obligations under this contract, Seller shall drill additional well or wells in said field and shall pay all charges and do all acts necessary to keep its leases in good standing and free from any default; provided, however, Seller shall not be required to drill any wells which would not be drilled by a reasonably prudent operator under similar circumstances, shall not be obligated to drill more than one well per 640 acres of productive area..."

And that contract, sir, has been varied to some extent by a provision contained in paragraph 11.(b). Under the old 11.(b) it was provided that the price to be paid

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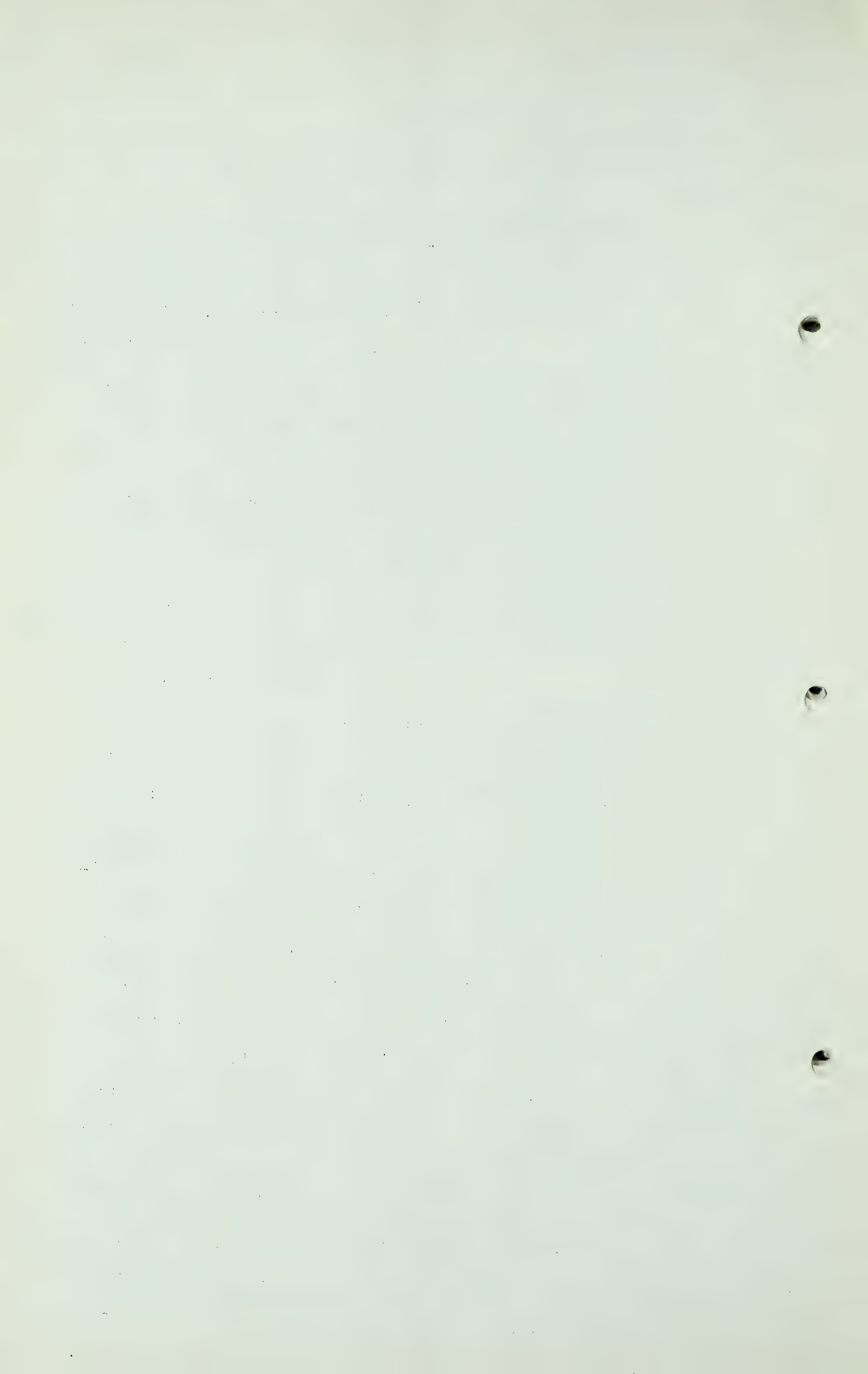
should be affected by the price of fuel oil, but by this variation the fluctuations in the prices of fuel oil no longer affect the price to be paid under the contract.

The contract itself is renewed from month to month and is in good standing, or has been varied, of course, by the arrangement which has been entered into between Canadian Western, and the Shell Company with respect to the gas to be taken from this Jumping Pound area. Or, I am sorry, it does affect the contract which I am discussing with regard to Standard Oil of California. That contract is also in good standing and has been renewed until January of 1951.

The section which deals with drilling is also number 4.(a) and provides that:

"Seller now has eight gas wells in the acreage shown on Exhibit 1 attached hereto. Upon notification from Buyer that it has received delivery from the mills of at least 15,000 tons of steel for construction of Buyer's pipe line system, Seller shall, with reasonable diligence, commence and drill an additional twelve wells in said acreage; provided, however, if Seller so elects, Seller may drill one or more of such wells prior to the time when Buyer is privileged to give such notification. If necessary for performance of its obligations under this contract, Seller shall drill an additional well or wells in said acreage."

And, as I say, Mr. Chairman, that contract is in good standing and has been renewed until January 1st, 1951,



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and I am going to ask, if you will, please, sir, give numbers to these exhibits. The last number was - -

THE CHAIRMAN: J-49.

MR. NOLAN: J-49. And the Imperial contract might be given number J-50, sir.

THE CHAIRMAN: Yes, J-50.

GAS CONTRACT BETWEEN NORTHWEST
NATURAL GAS COMPANY AND IMPERIAL
OIL LIMITED, DATED AUGUST 30th,
1948 MARKED EXHIBIT J-50.

MR. NOLAN: And the Shell contract be given exhibit number J-51.

THE CHAIRMAN: Exhibit J-51.

GAS CONTRACT BETWEEN NORTHWEST
NATURAL GAS COMPANY AND SHELL
OIL COMPANY OF CANADA LIMITED,
dated SEPTEMBER 24th, 1948
MARKED EXHIBIT J-51.

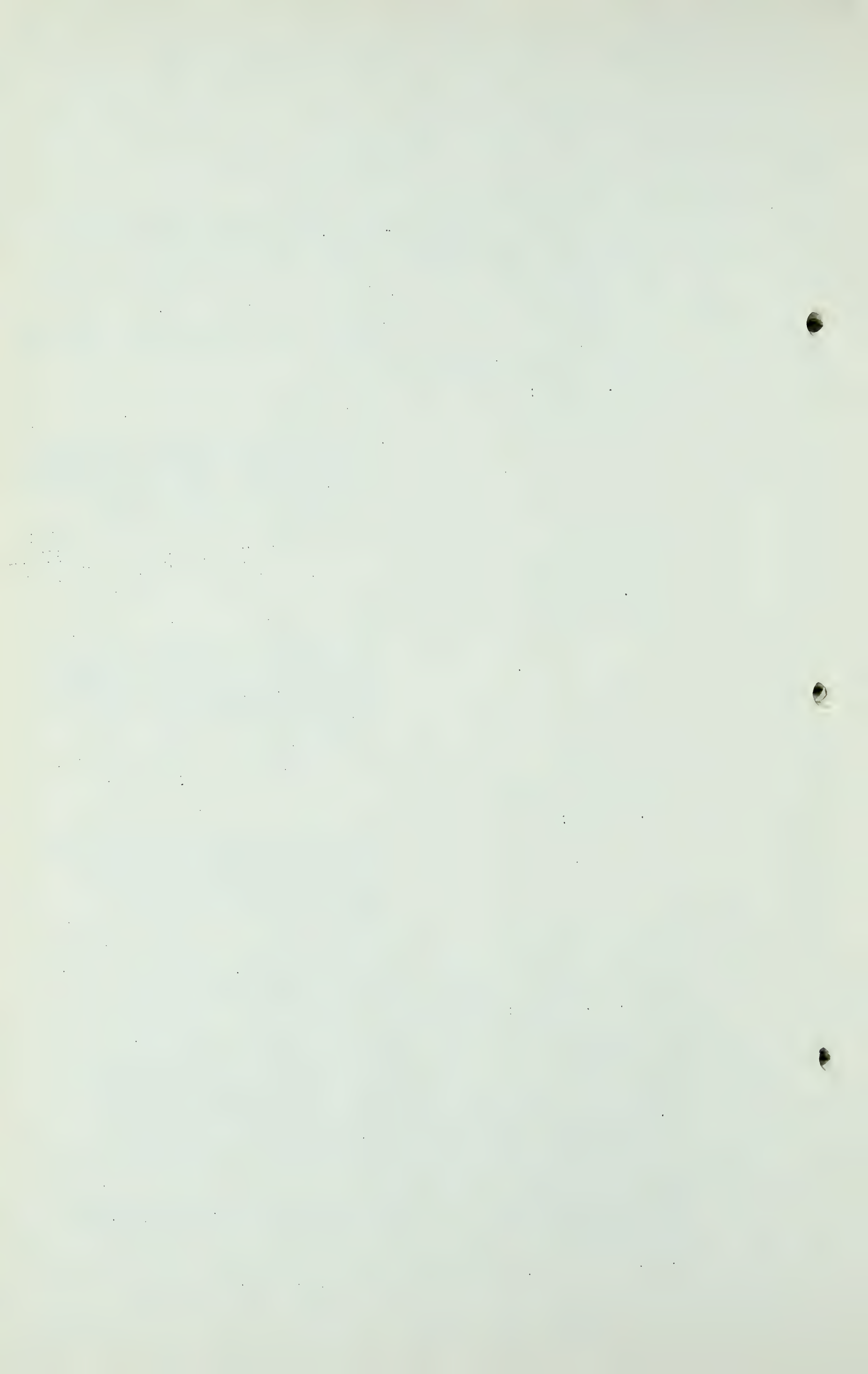
MR. NOLAN: And the California Standard contract, J-52.

GAS CONTRACT BETWEEN NORTHWEST
GAS COMPANY AND CALIFORNIA
STANDARD NATURAL GAS COMPANY,
DATED OCTOBER 13, 1948,
MARKED EXHIBIT J-52.

MR. C. E. SMITH: These Imperial contracts, the Imperial and California Standard contracts are still in good standing according to their present form, Mr. Nolan?

MR. NOLAN: Well, the situation has changed with regard to Imperial because the Imperial sold out its holdings, but the California Standard is in good standing in its present form.

MR. C. E. SMITH: Have you got copies to give to the Board?



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MR. NOLAN: I have copies for the Board but I have not got copies to give to my learned friends because the Board has all my copies.

THE CHAIRMAN: They are available?

MR. C. E. SMITH: We have three copies here.

MR. NOLAN: Thank you very much.

THE CHAIRMAN: Gentlemen: You will recall that on September 28th I addressed you as follows:-

"The Board is prepared to hold a joint hearing on October 30th, 1950, for the purpose of hearing evidence, or further evidence, of all applicants and any interested parties in regard to reserves, deliverability and the requirements of the Province. It is our hope that all interested parties will take advantage of the joint hearing to see that the Board is provided with the fullest information on reserves, deliverability and Provincial requirements.

We are not prepared at this time to make a statement with respect to the point raised by Mr. Martland relating to choice of routes being referred to the Board of Transport Commissioners. Should the disposition of applications be decided without reference to the Board of Transport Commissioners, the Board at the request of any applicant will hear any further evidence and applicant may wish to present with respect to any matter relating to other than reserves, deliverability and Provincial requirements. In the

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"meantime any applicant should file such evidence with the Board."

The Board is not presently ready to decide or even comment on the suggested reference to the Board of Transport Commissioners and will not be able to do so until it has had a further opportunity to consider the evidence submitted at this joint hearing.

Should the Board require evidence on matters other than those dealt with in this joint hearing, from applicants who have not as yet had an opportunity of submitting such evidence, all parties registered before the Board as interested will be notified accordingly and an opportunity thus given for both direct and cross-examination on such other matters.

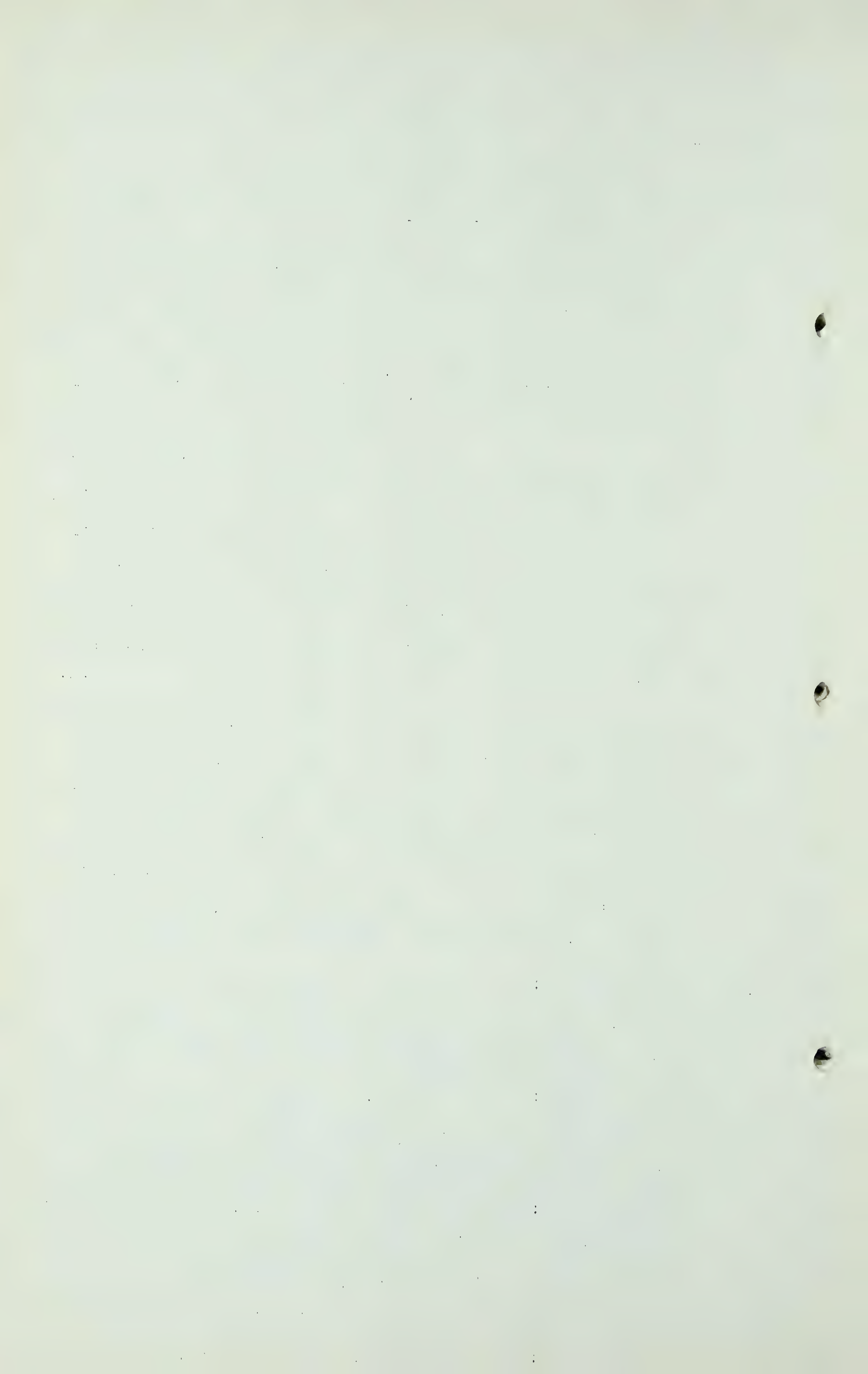
The Board is desirous that all interested parties should now submit written arguments to the extent that they deem advisable. All reasonable speed in connection therewith is, I think, desirable by all and will be appreciated by the Board.

MR. McDONALD: Does the Board suggest any time limit, Mr. Chairman, with regard to this submission of argument?

THE CHAIRMAN: No, I think we will leave it up to counsel, Mr. McDonald, but we would like to have it as quickly as possible.

MR. McDONALD: I take it, sir, that any filings with regard to matters which have not been dealt with here are simply filings that will be made with the Board and will be delivered to any parties interested?

THE CHAIRMAN: Yes, they should be.



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MR. C. E. SMITH: If counsel desires a time limit on written submissions probably they could indicate to the Board how long they desire. I think they are all in as much of a hurry as the Board. I do not think the Board wants to set an exact time limit. Have you any ideas about time, Mr. McDonald?

MR. McDONALD: I was going to suggest, sir, 30 days, by December 15th, that that would not be unreasonable.

THE CHAIRMAN: I think that is reasonable, Mr. McDonald, unless any counsel does not think that is a reasonable length of time?

MR. NOLAN: I am a bit staggered at the thought, sir. When I regain my composure, I might be able to give a better estimate of how long would be required.

MR. C. E. SMITH: That is the usual sentence for first offenders, Harry, 30 days.

MR. NOLAN: With time off for good behaviour. We would be very anxious to get ours in as soon as possible, and we would be loathe to have the time extended beyond 30 days, because of the necessity of terminating these proceedings.

THE CHAIRMAN: If there is nothing further, gentlemen, the hearing will adjourn.

(The Joint Hearing was then adjourned.)

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Mr. E. E. Smith: It seemed to me a time when

the weather was very much like that of the day before

the day before yesterday. I think they are all in

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